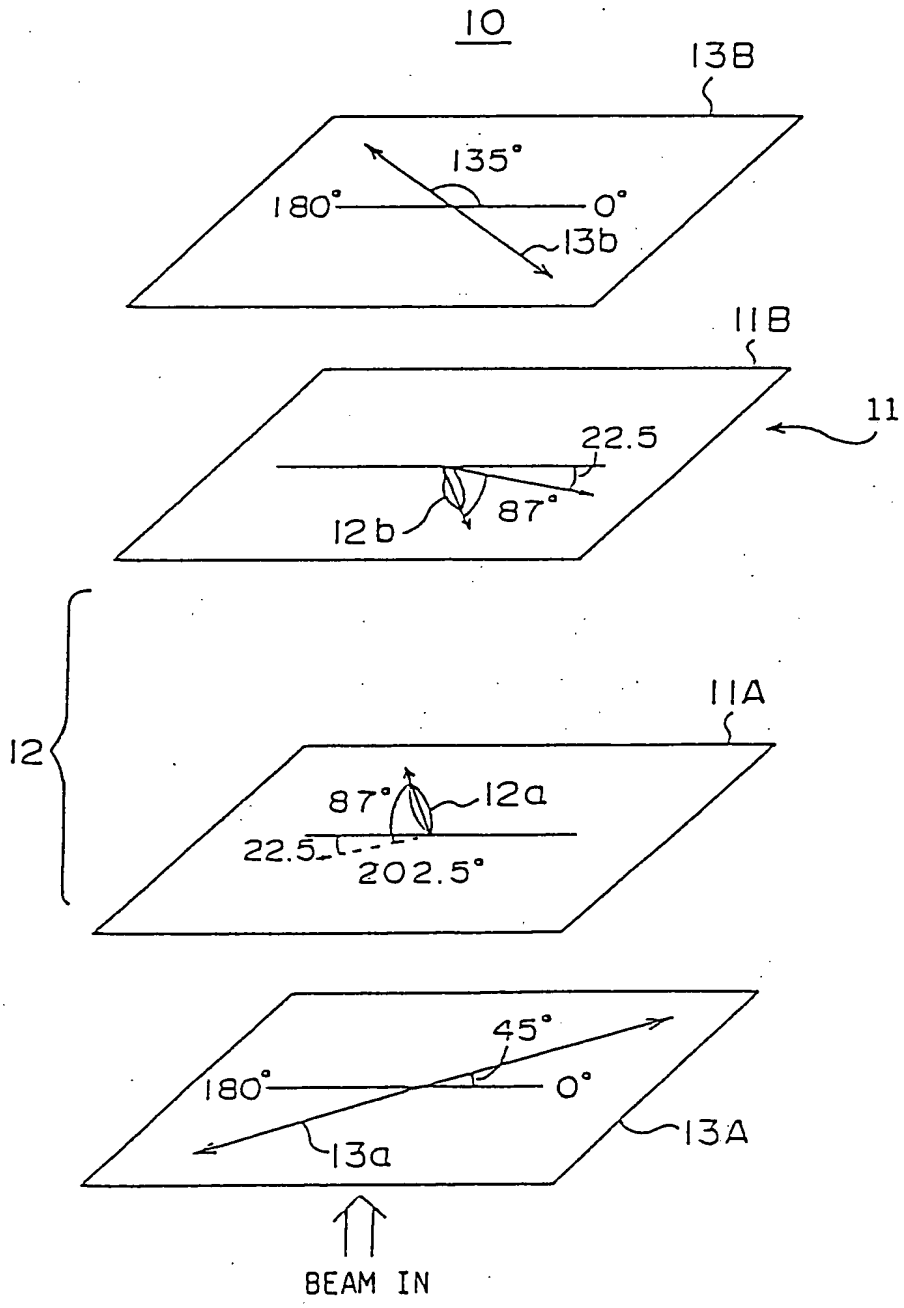
OIPE JC95
JAN 23 2004
PATENT & TRADEMARK OFFICE

FIG. 1



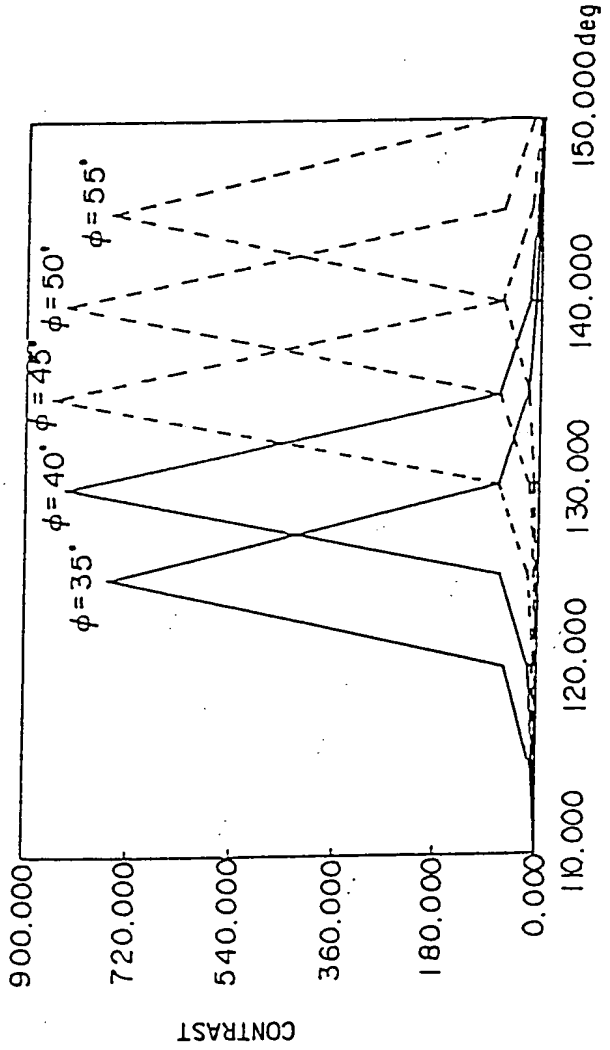

CONTRAST
900.000
720.000
540.000
360.000
180.000
0.000
110.000
120.000
130.000
140.000
150.000deg
ABSORPTION AXIS OF ANALYZER
φ=35°
φ=40°
φ=45°
φ=50°
φ=55°

FIG. 2A

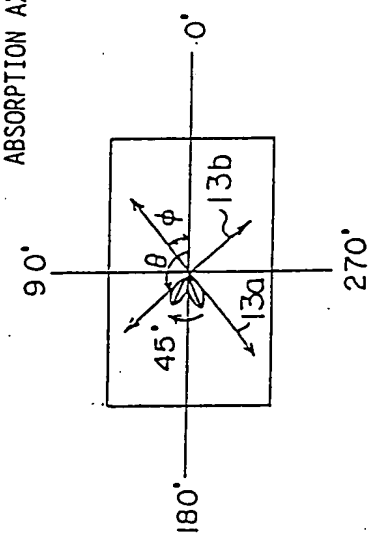

0°
90°
180°
270°
45°
θ
φ
13a
13b

FIG. 2B

FIG. 3A

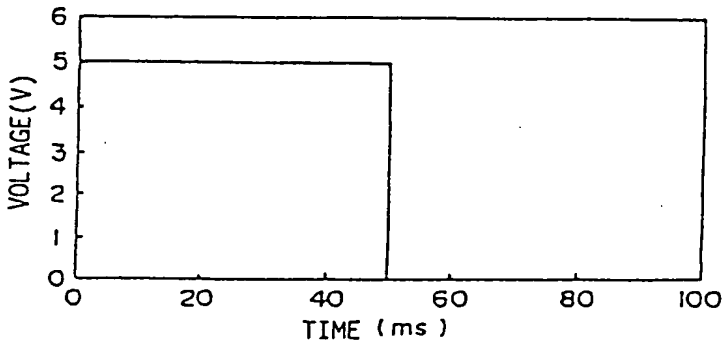


FIG. 3B

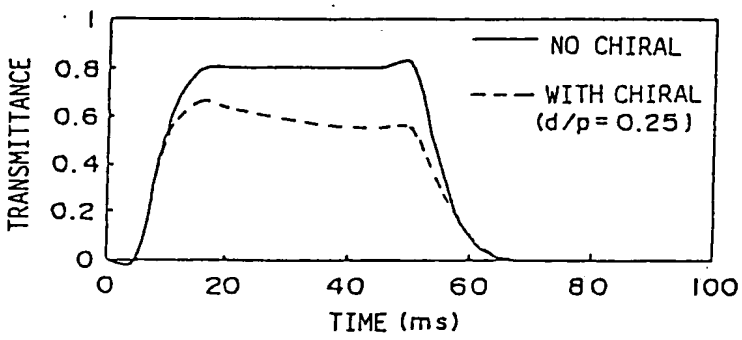


FIG. 3C

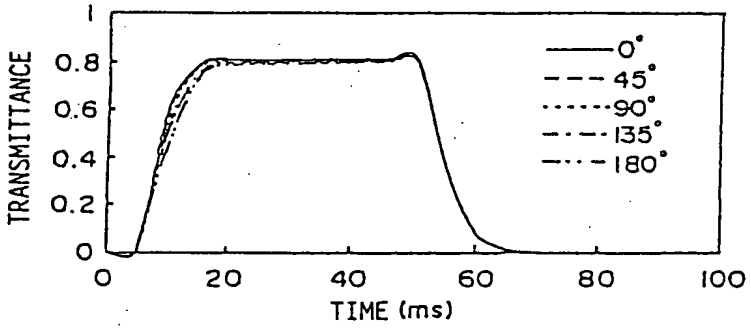


FIG. 3D

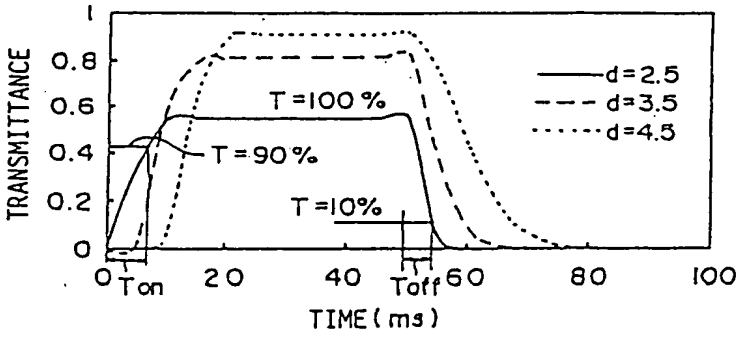


FIG.4A

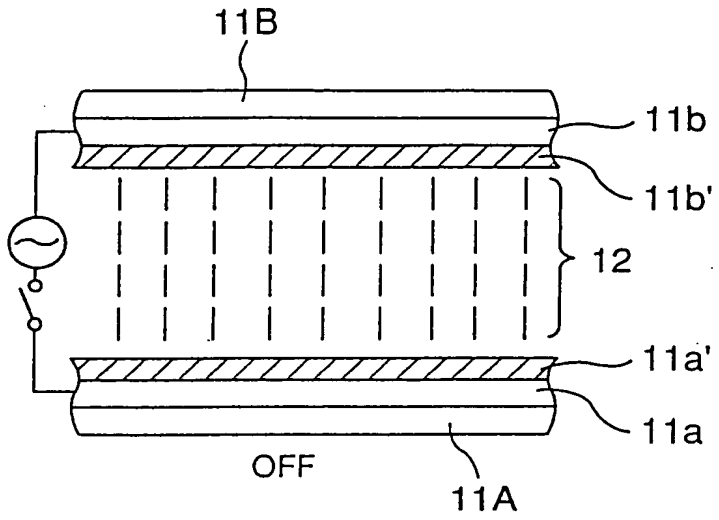


FIG.4B

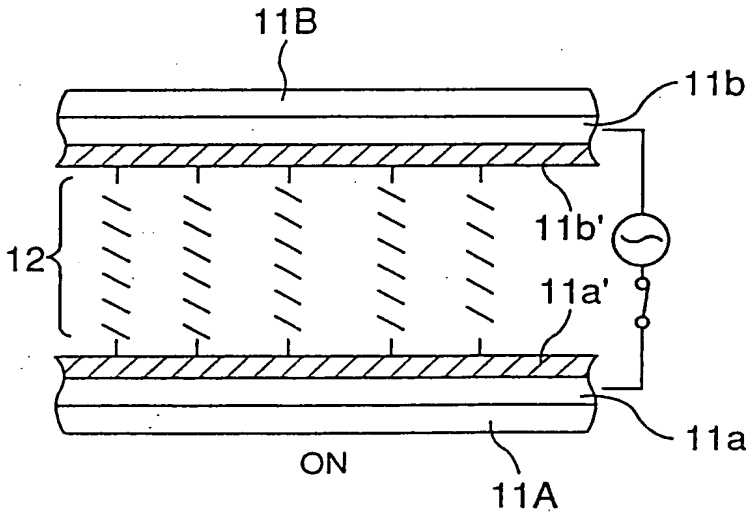


FIG.5A

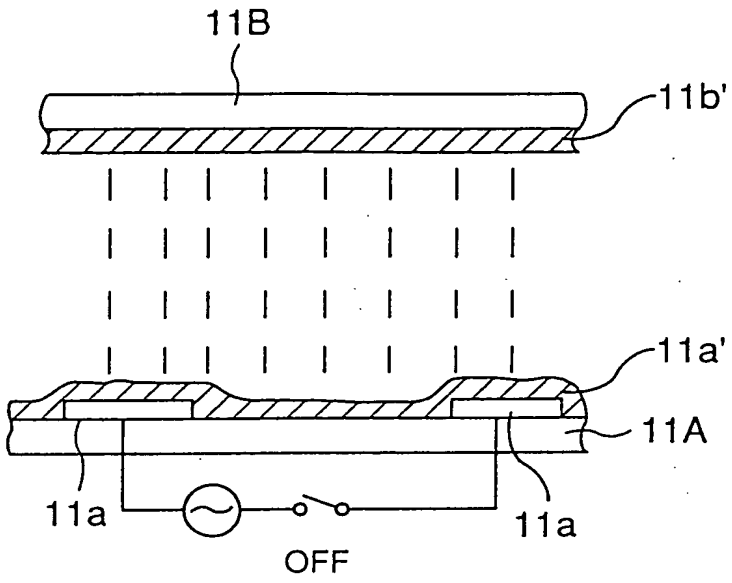


FIG.5B

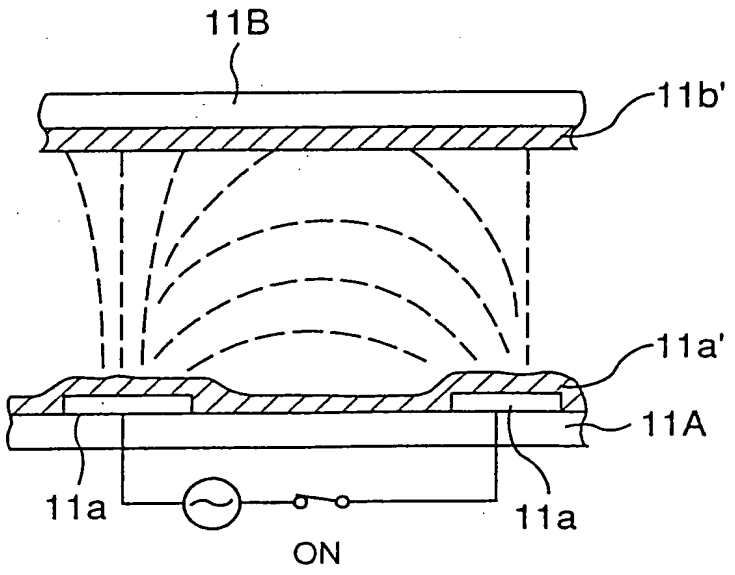


FIG.6A

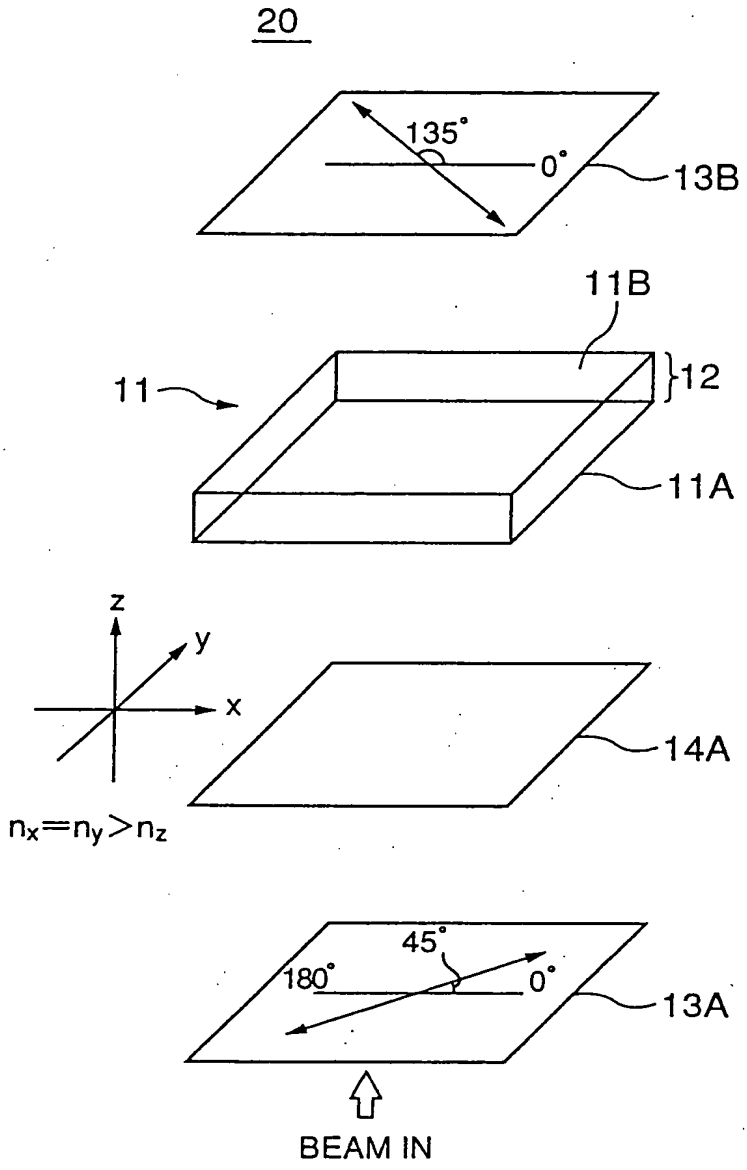


FIG. 6B

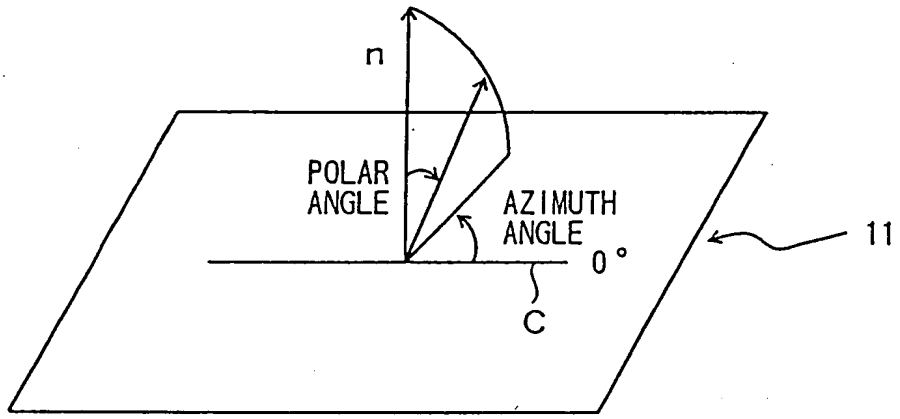
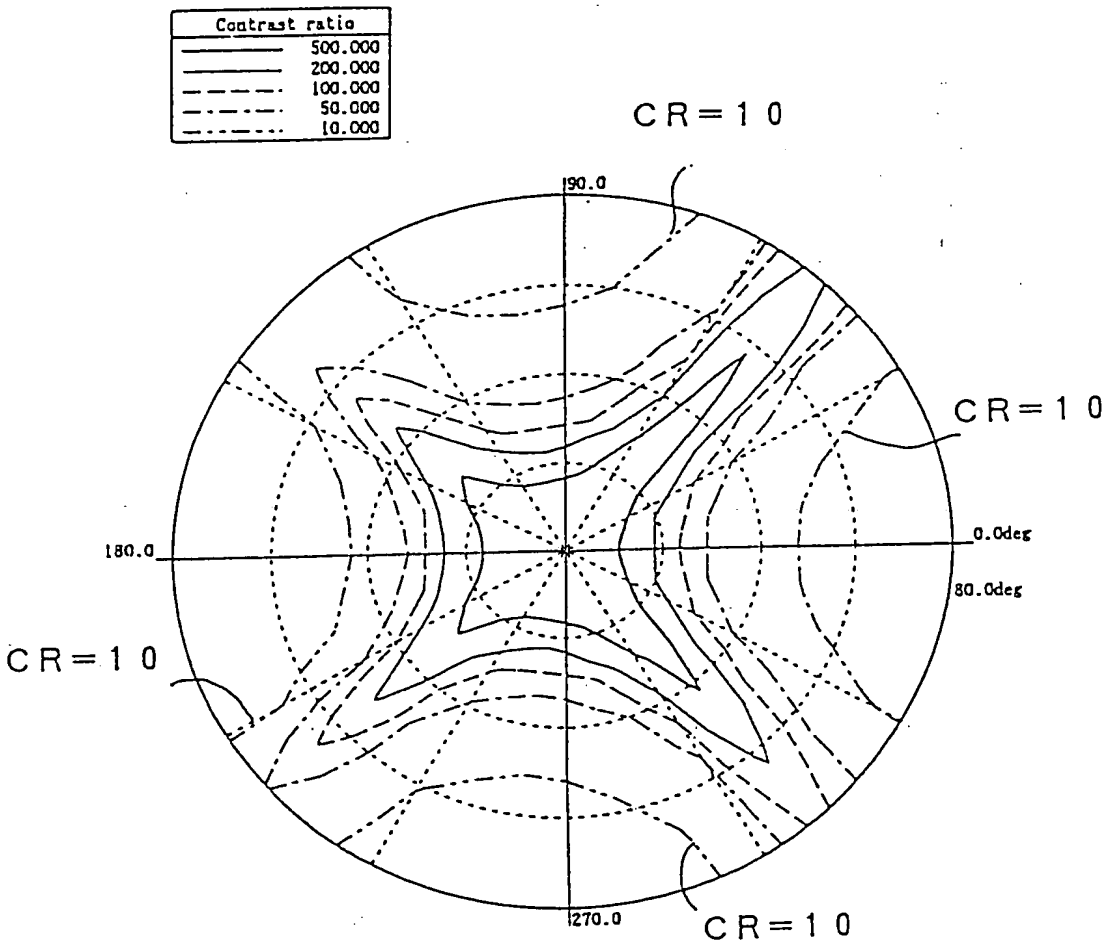
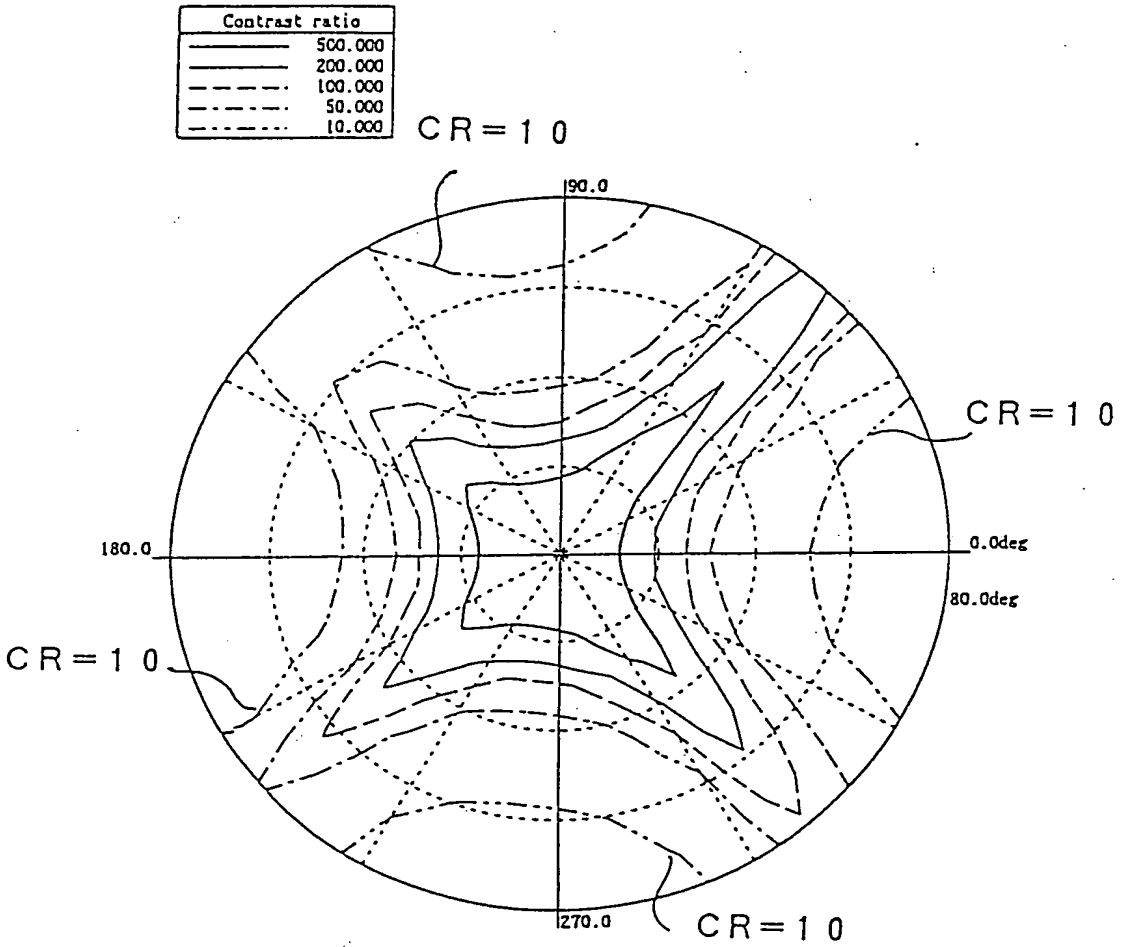


FIG. 7



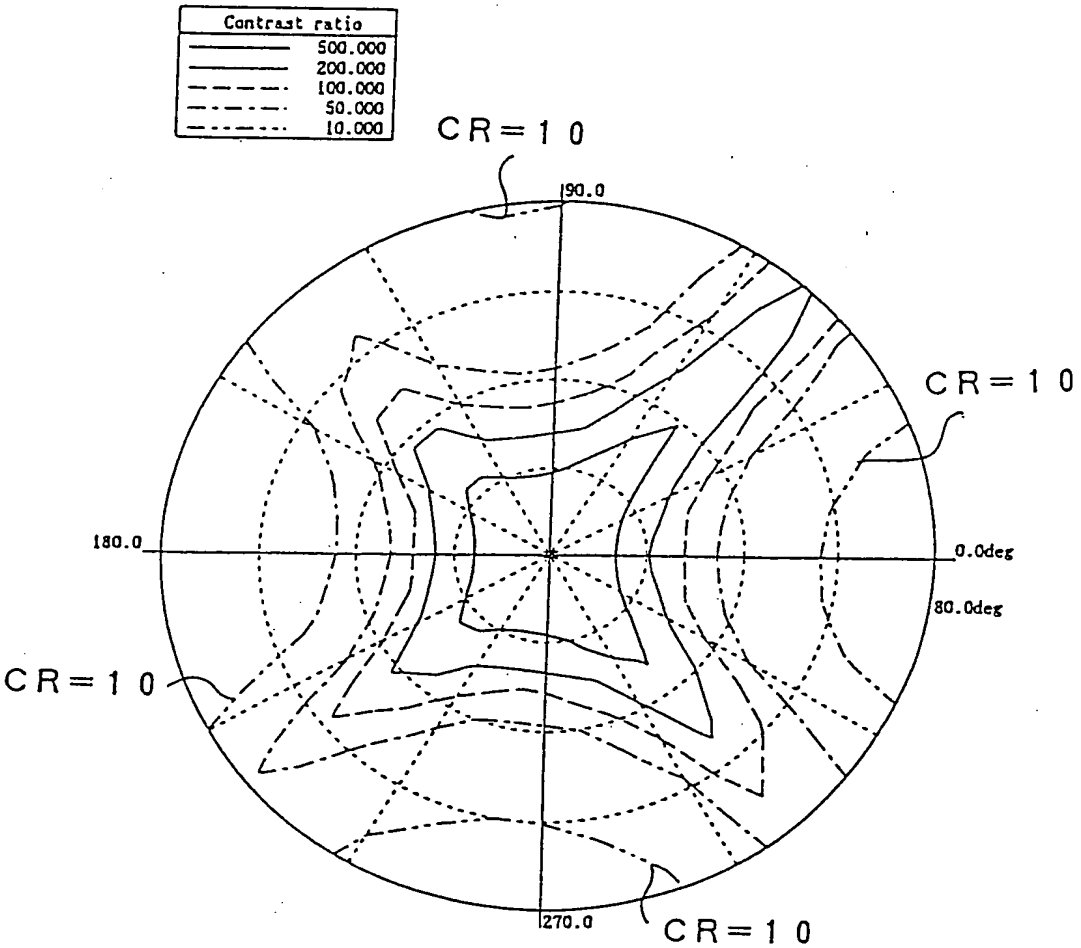
$$\frac{R'}{\Delta n d} = 0.45$$

FIG. 8



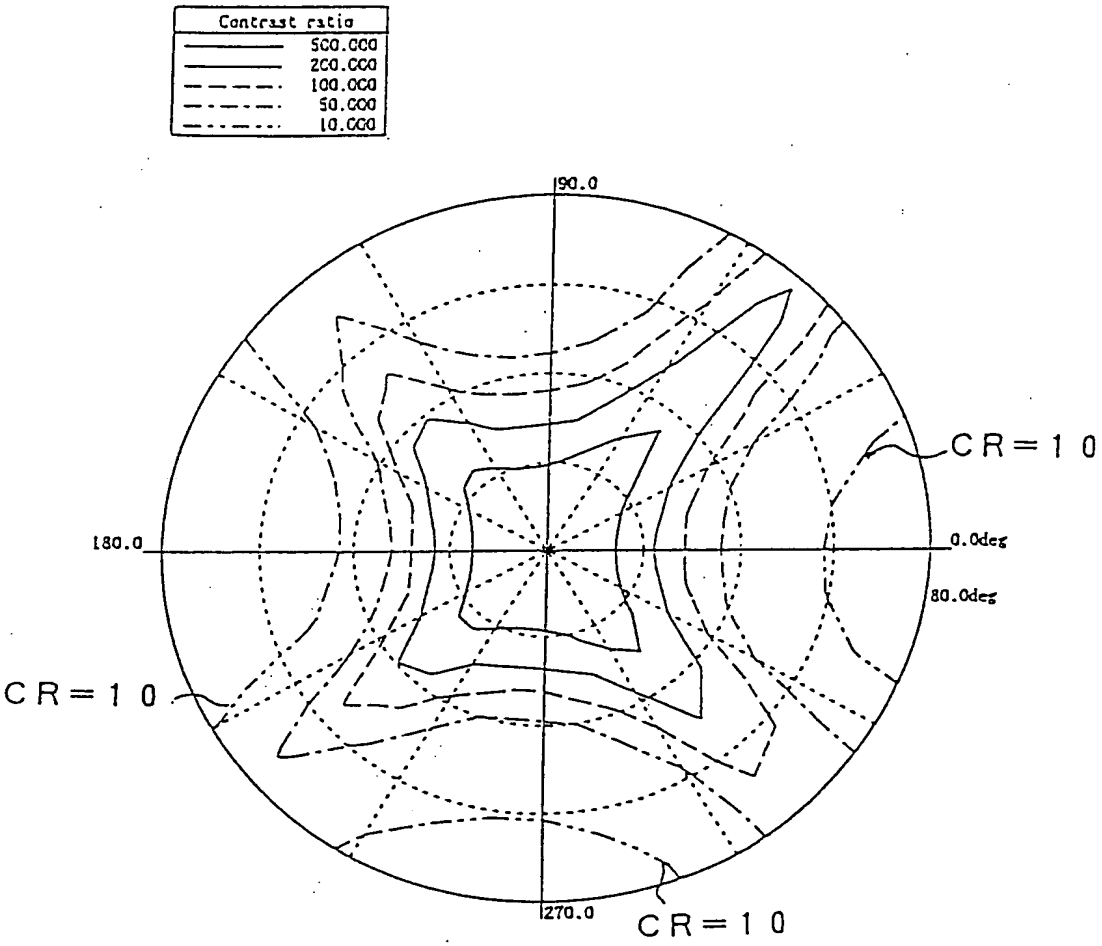
$$\frac{R'}{\Delta n d} = 0.6$$

FIG. 9



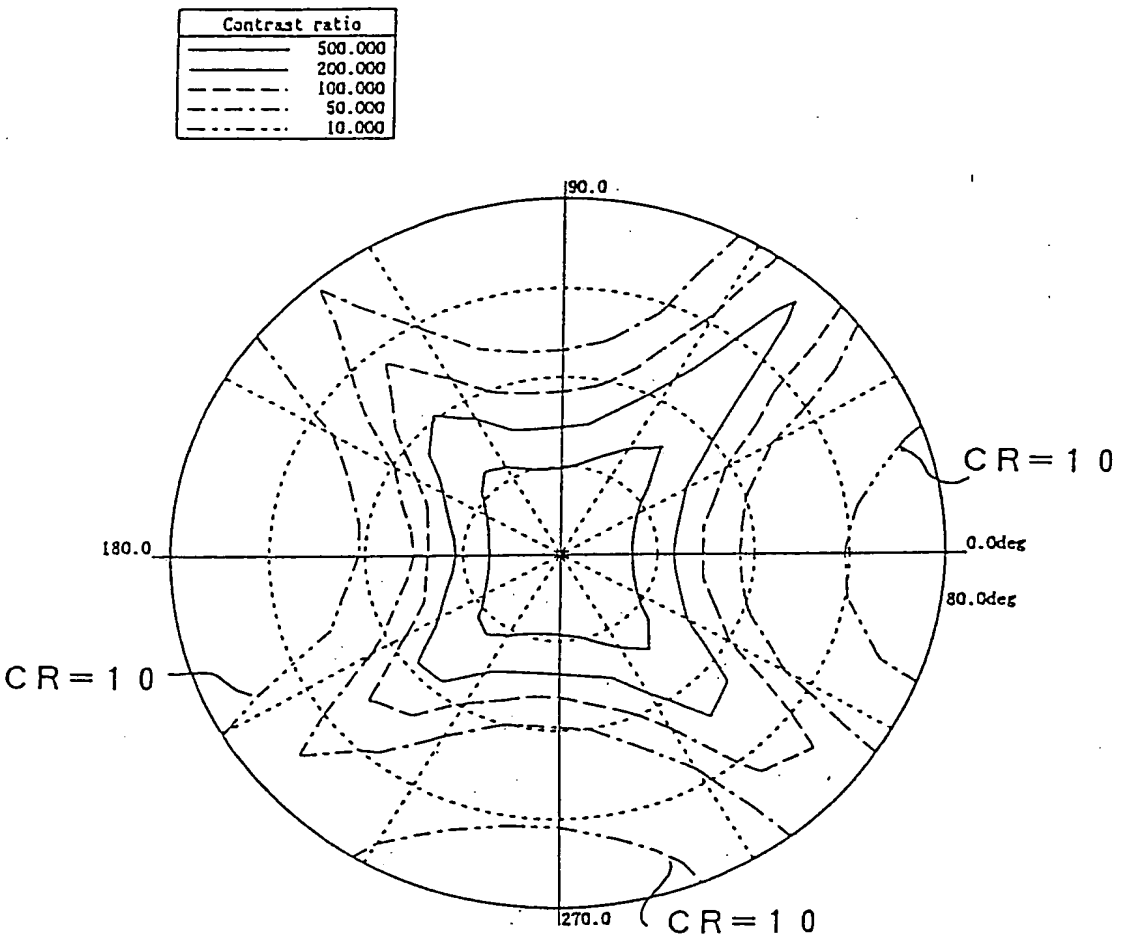
$$\frac{R'}{\Delta nd} = 0.75$$

FIG. 10



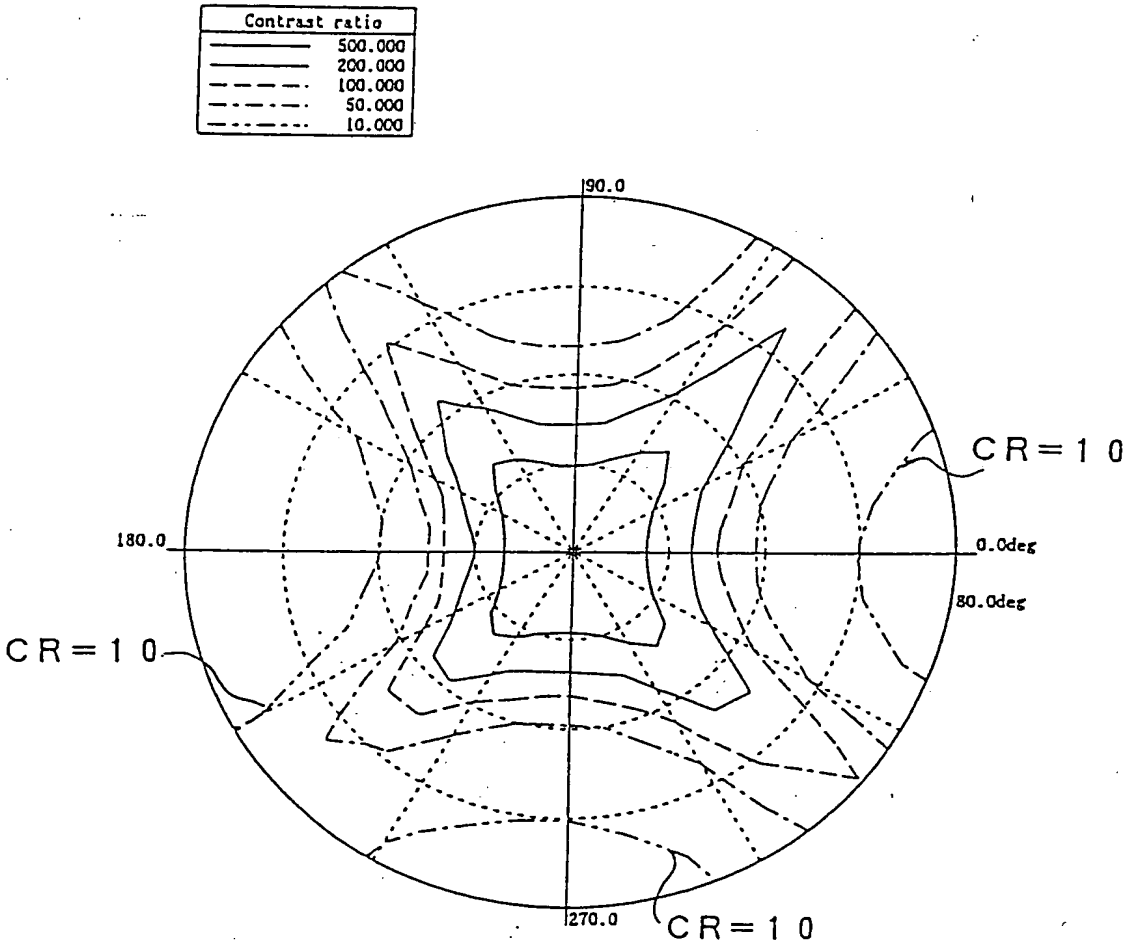
$$\frac{R'}{\Delta n d} = 0.82$$

FIG. 11



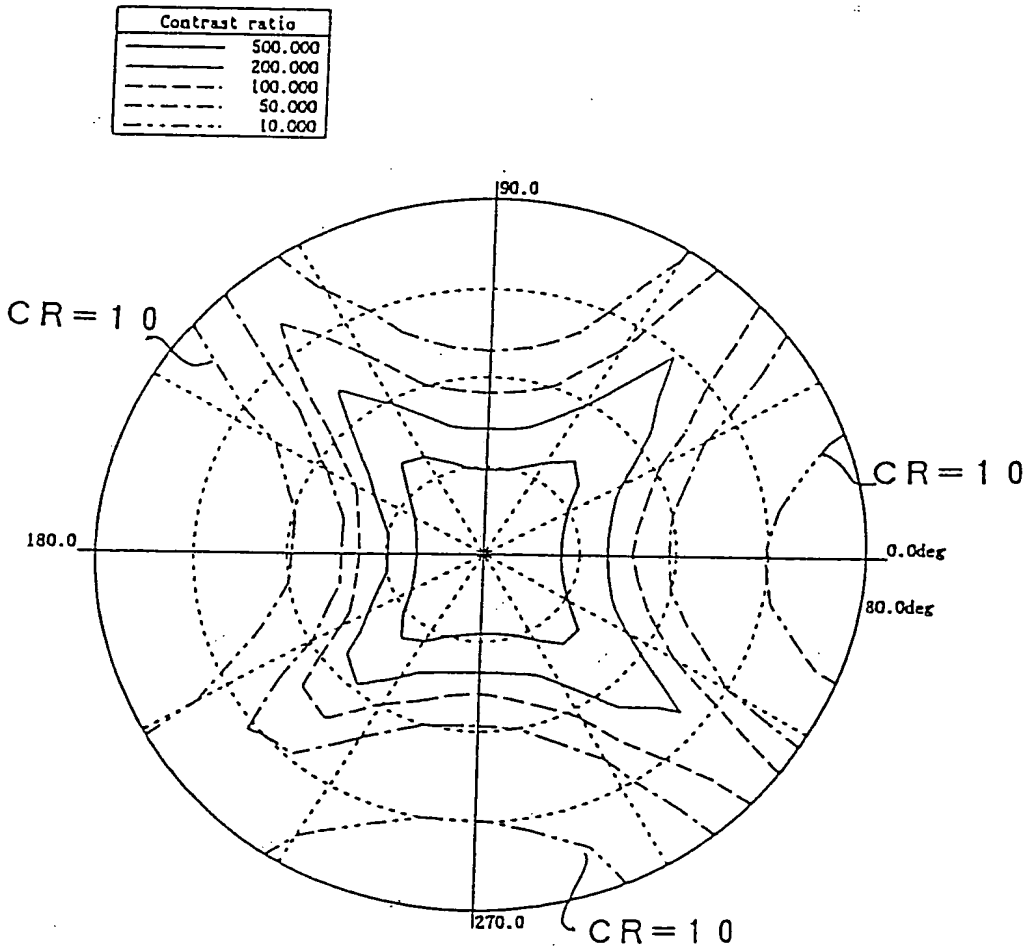
$$\frac{R'}{\Delta n d} = 0.90$$

FIG. 12



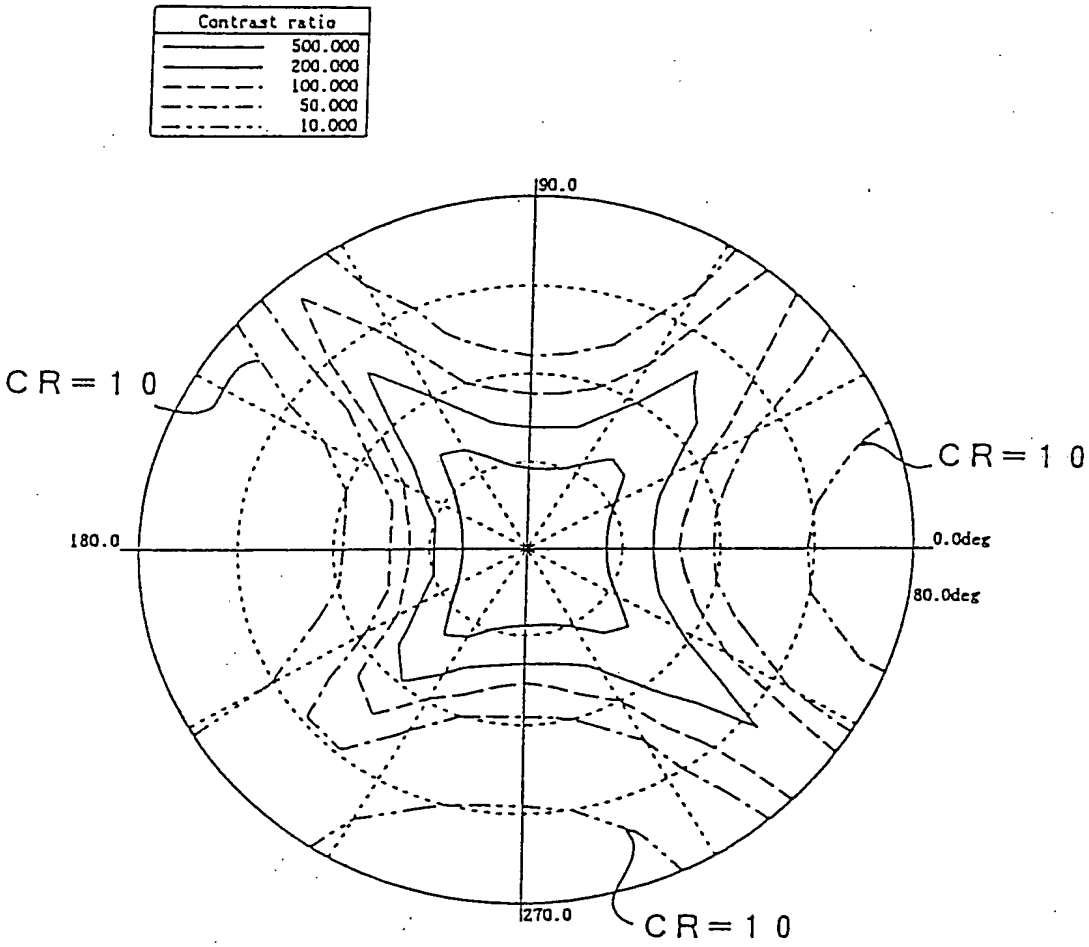
$$\frac{R'}{\Delta n d} = 0.97$$

FIG. 13



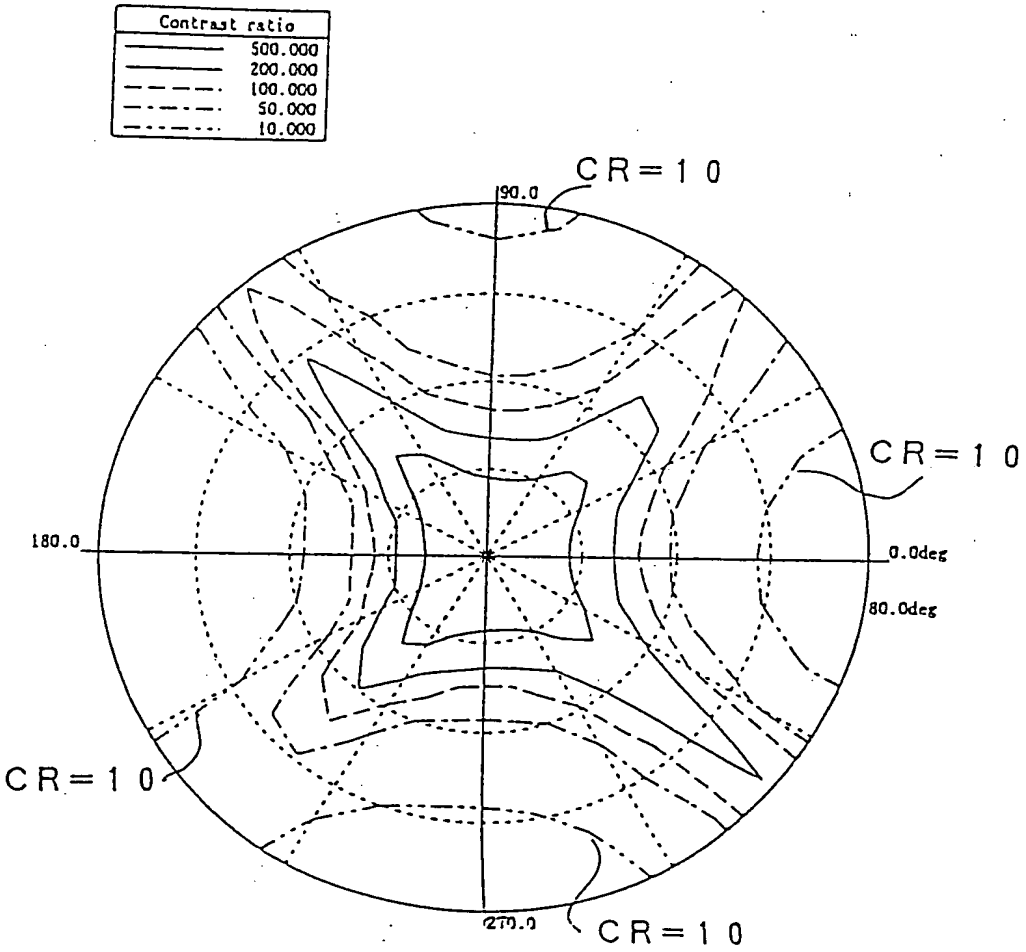
$$\frac{R'}{\Delta n d} = 1.05$$

FIG. 14



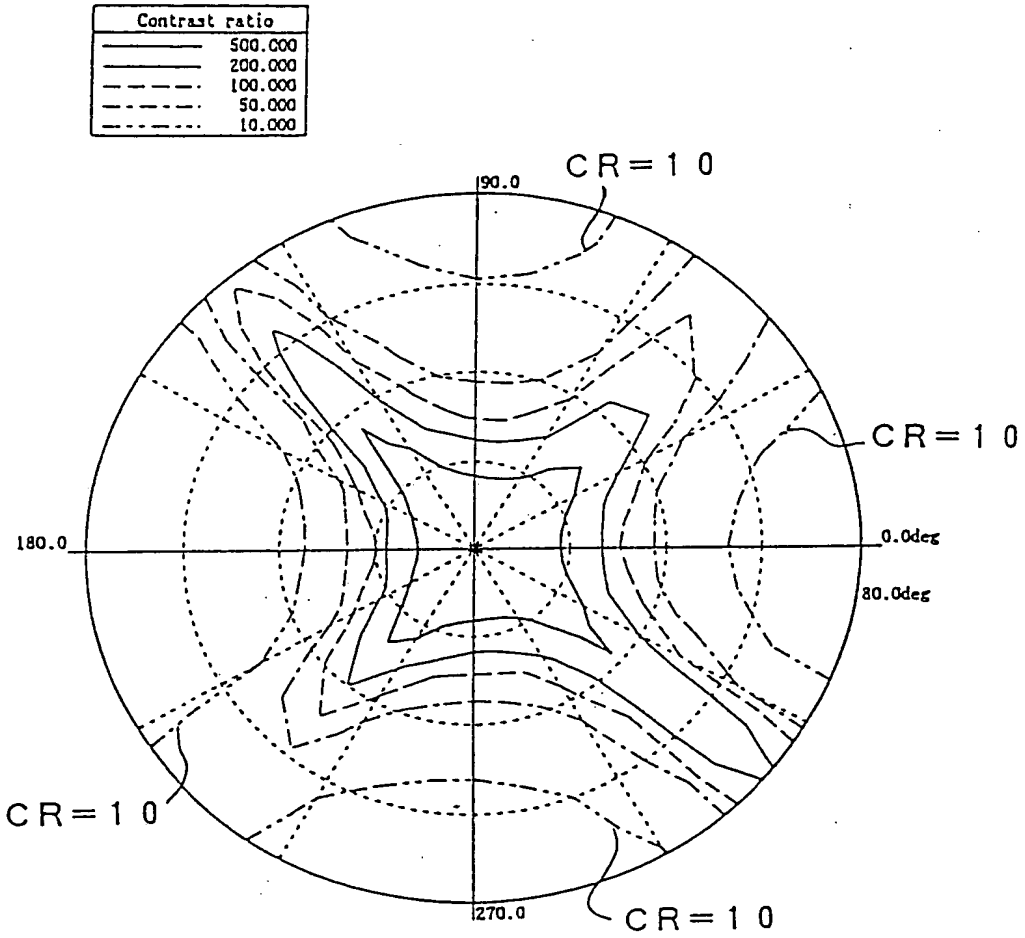
$$\frac{R'}{\Delta n d} = 1.12$$

FIG. 15



$$\frac{R'}{\Delta n d} = 1.20$$

FIG. 16



$$\frac{R'}{\Delta n d} = 1.34$$

FIG. 17

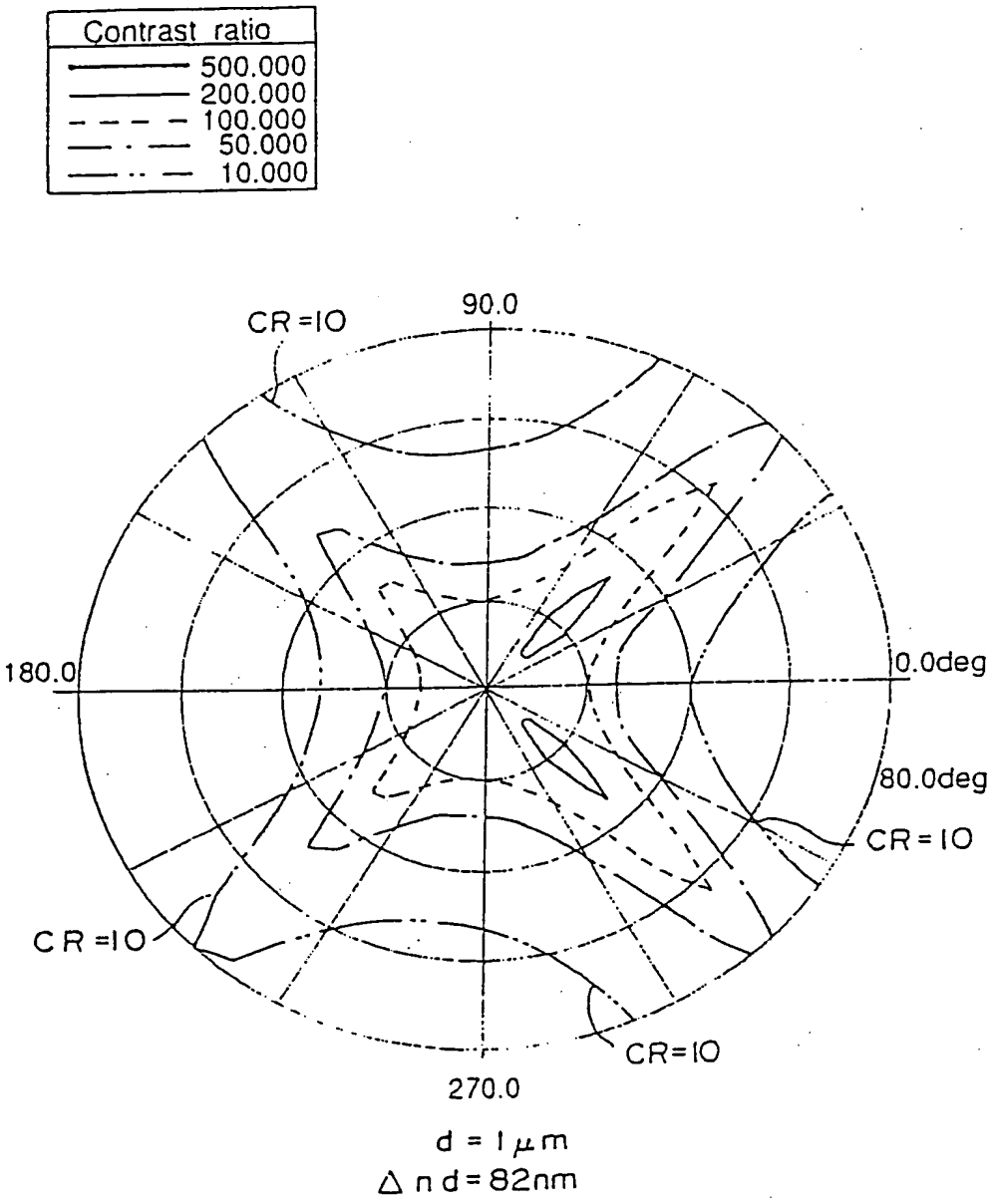

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
CR=10
180.0
0.0deg
80.0deg
CR=10
CR=10
CR=10
270.0
d = 1 μm
Δ n d = 82nm

FIG. 18

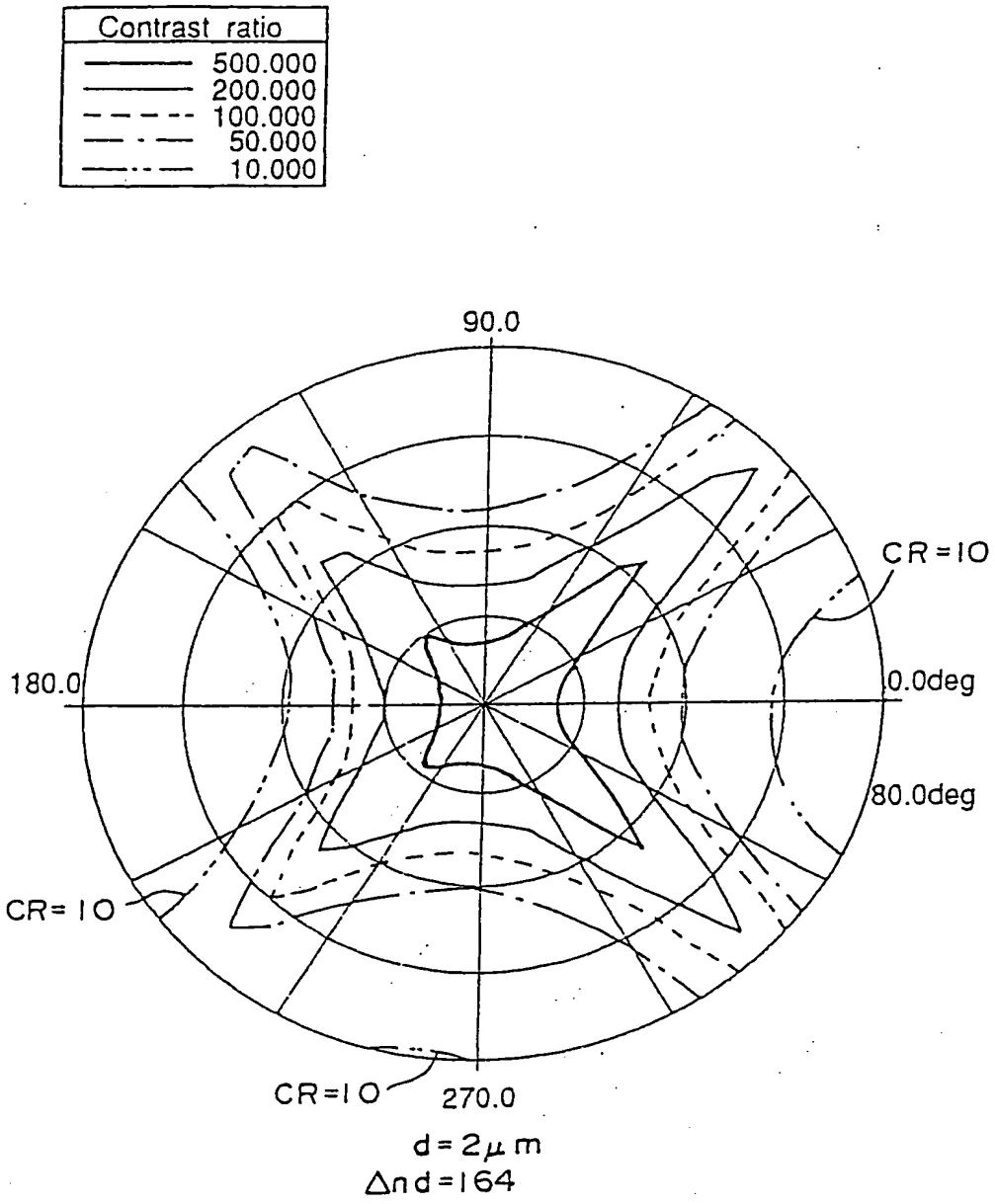

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
80.0deg
270.0
CR=10
CR=10
CR=10
d=2μm
Δnd=164

FIG. 19

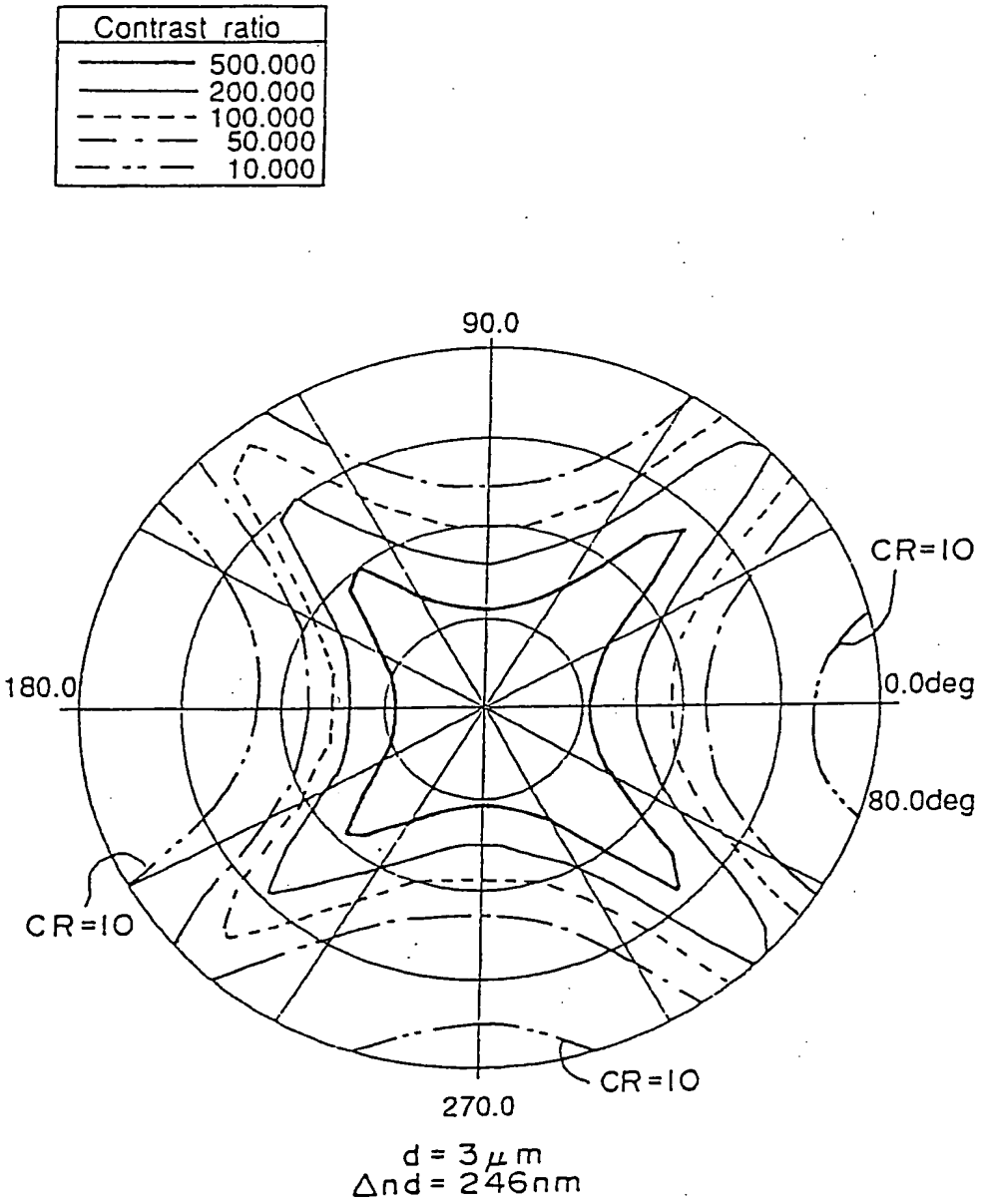
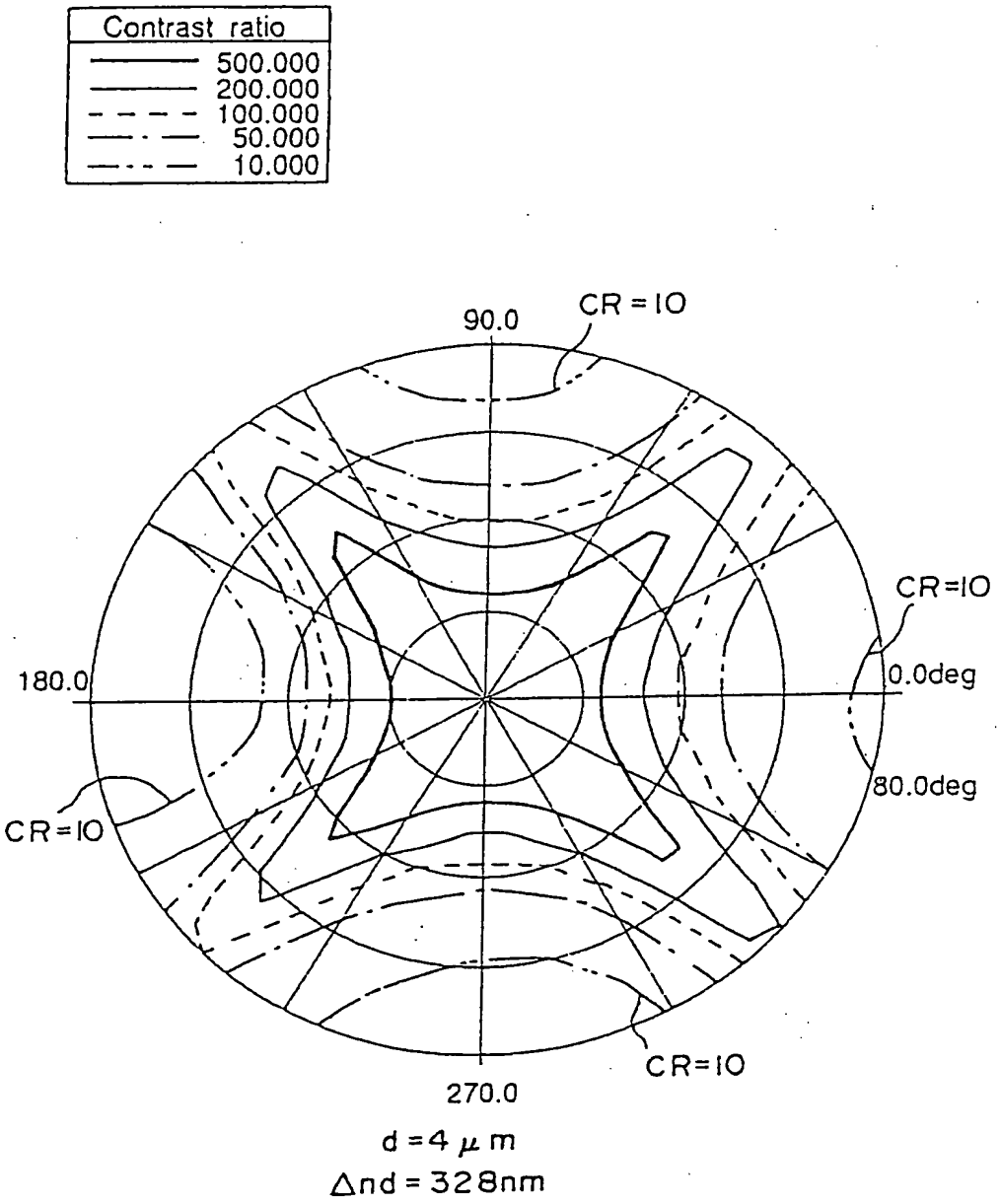

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
80.0deg
270.0
CR=10
CR=10
CR=10
d = 3 μm
Δnd = 246nm

FIG. 20



d = 4 μm

Δnd = 328nm

FIG. 21

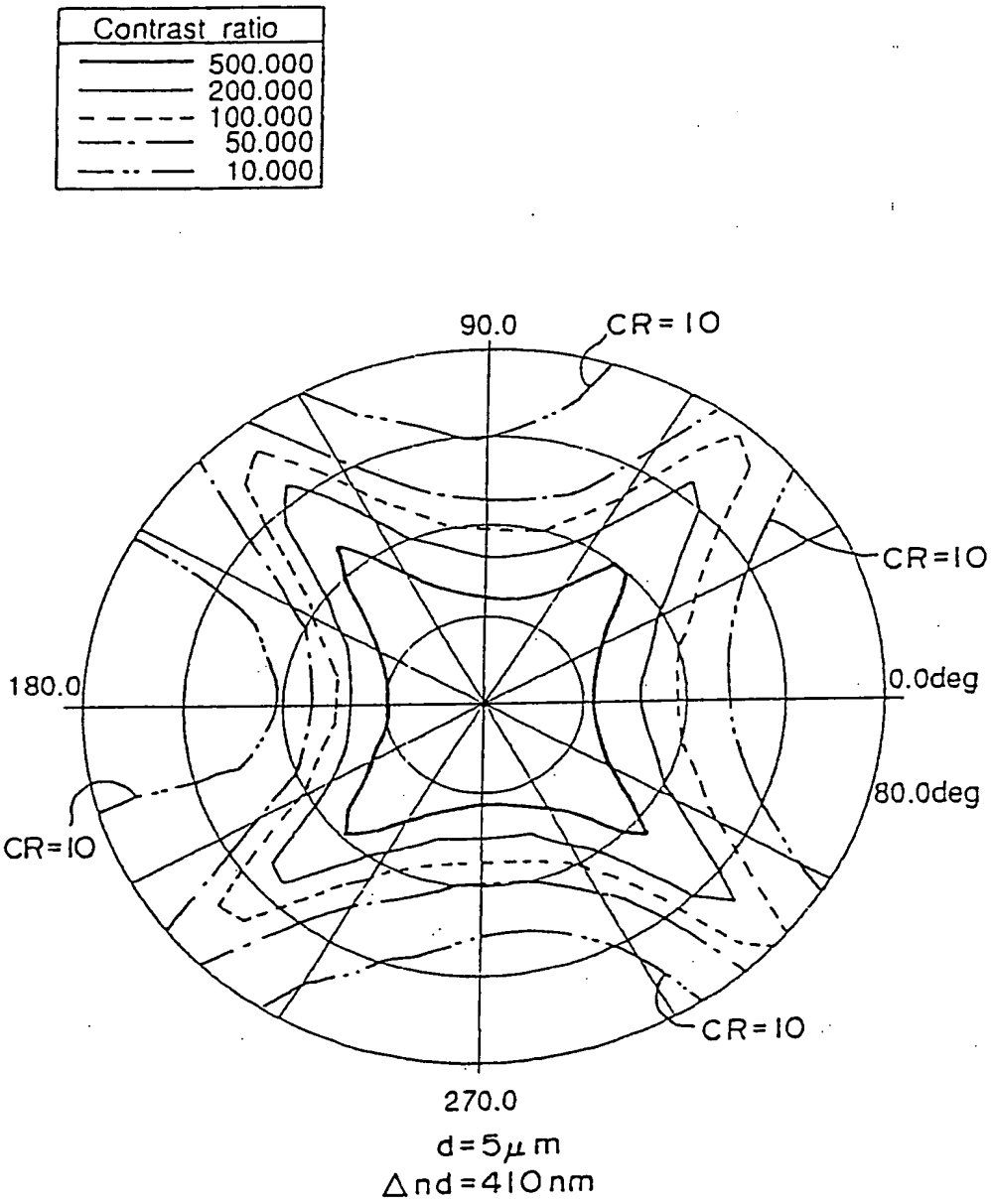
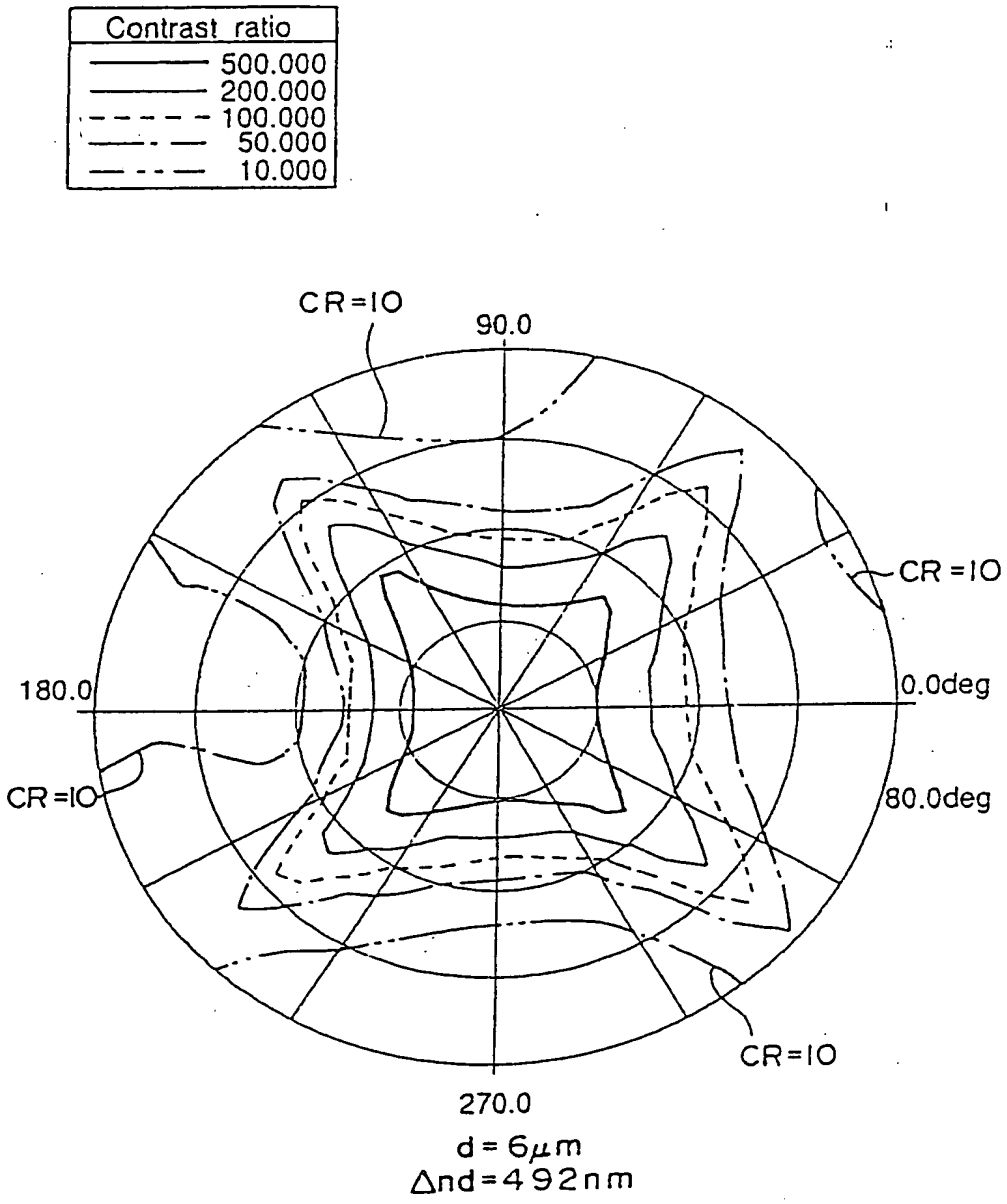

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
CR=10
CR=10
180.0
0.0deg
80.0deg
CR=10
CR=10
270.0
d=5μm
Δnd=410nm

FIG. 22


Contrast ratio
500.000
200.000
100.000
50.000
10.000
CR=10
90.0
CR=10
180.0
0.0deg
CR=10
80.0deg
CR=10
270.0
d=6μm
Δnd=492nm

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(James K. Folker)
(312) 360-0080

FIG. 23

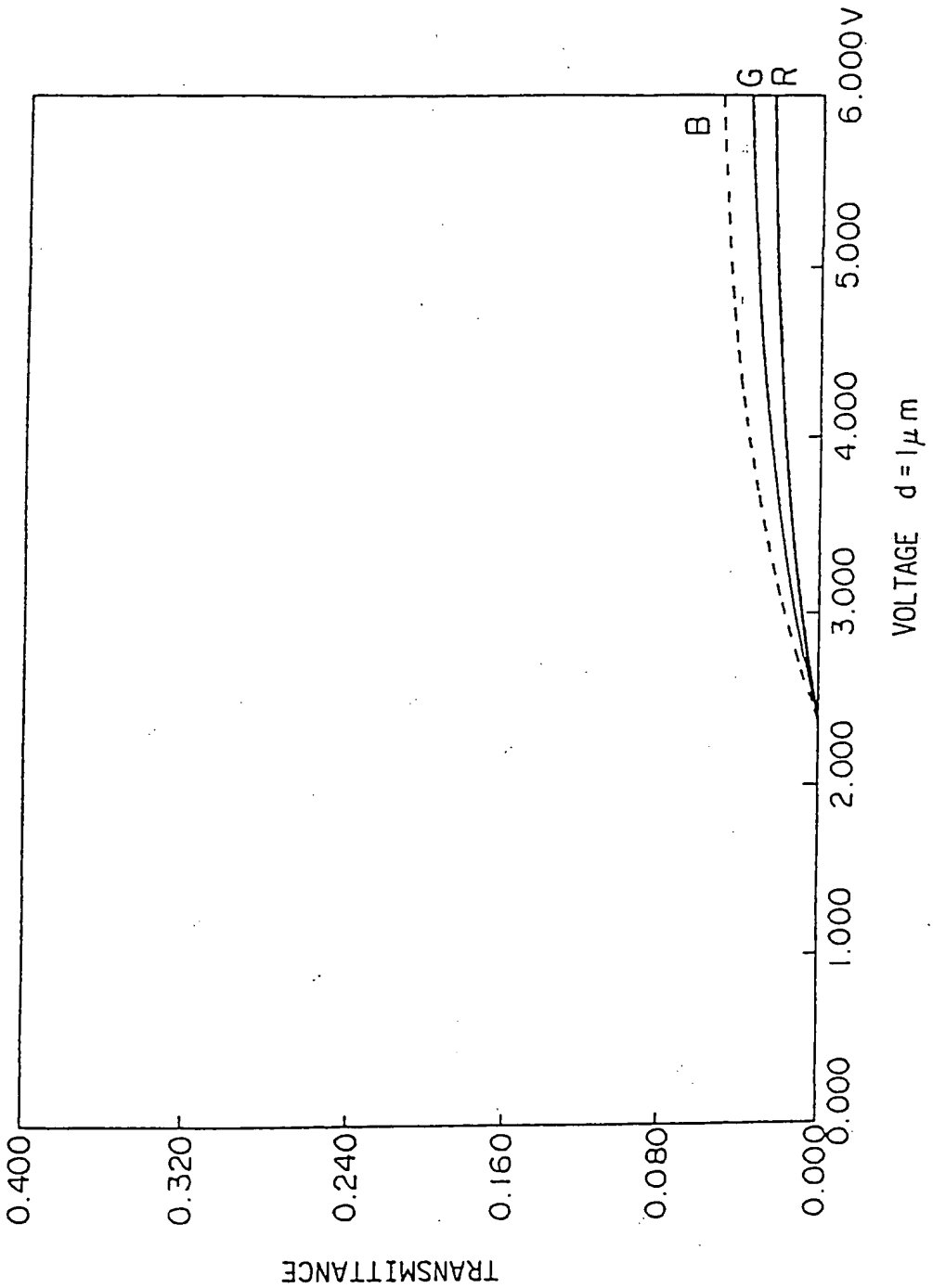


FIG. 24

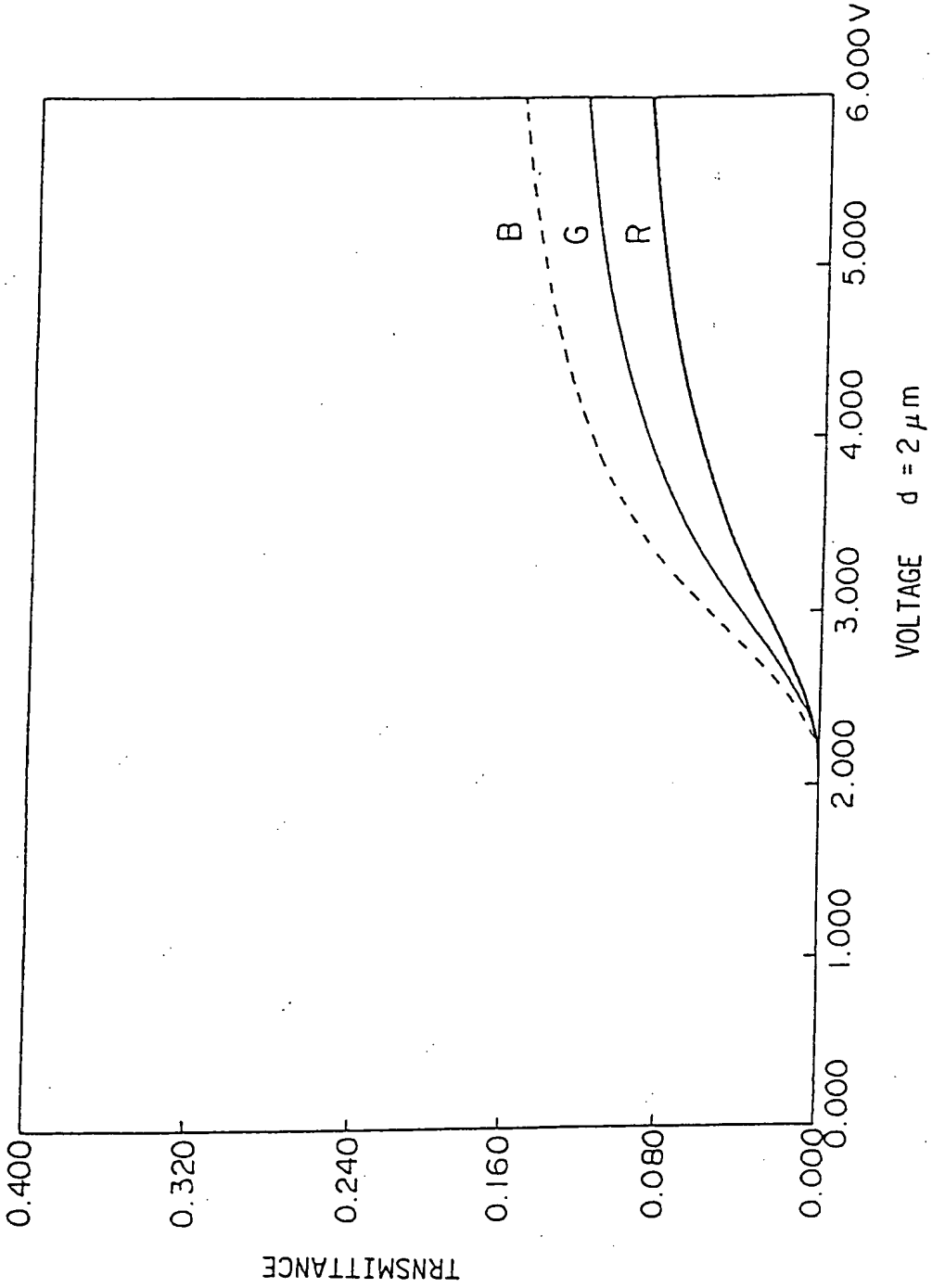

TRANSMITTANCE
0.400
0.320
0.240
0.160
0.080
0.000
0.000
1.000
2.000
3.000
4.000
5.000
6.000V
VOLTAGE d = 2 μm
B
G
R

FIG. 25

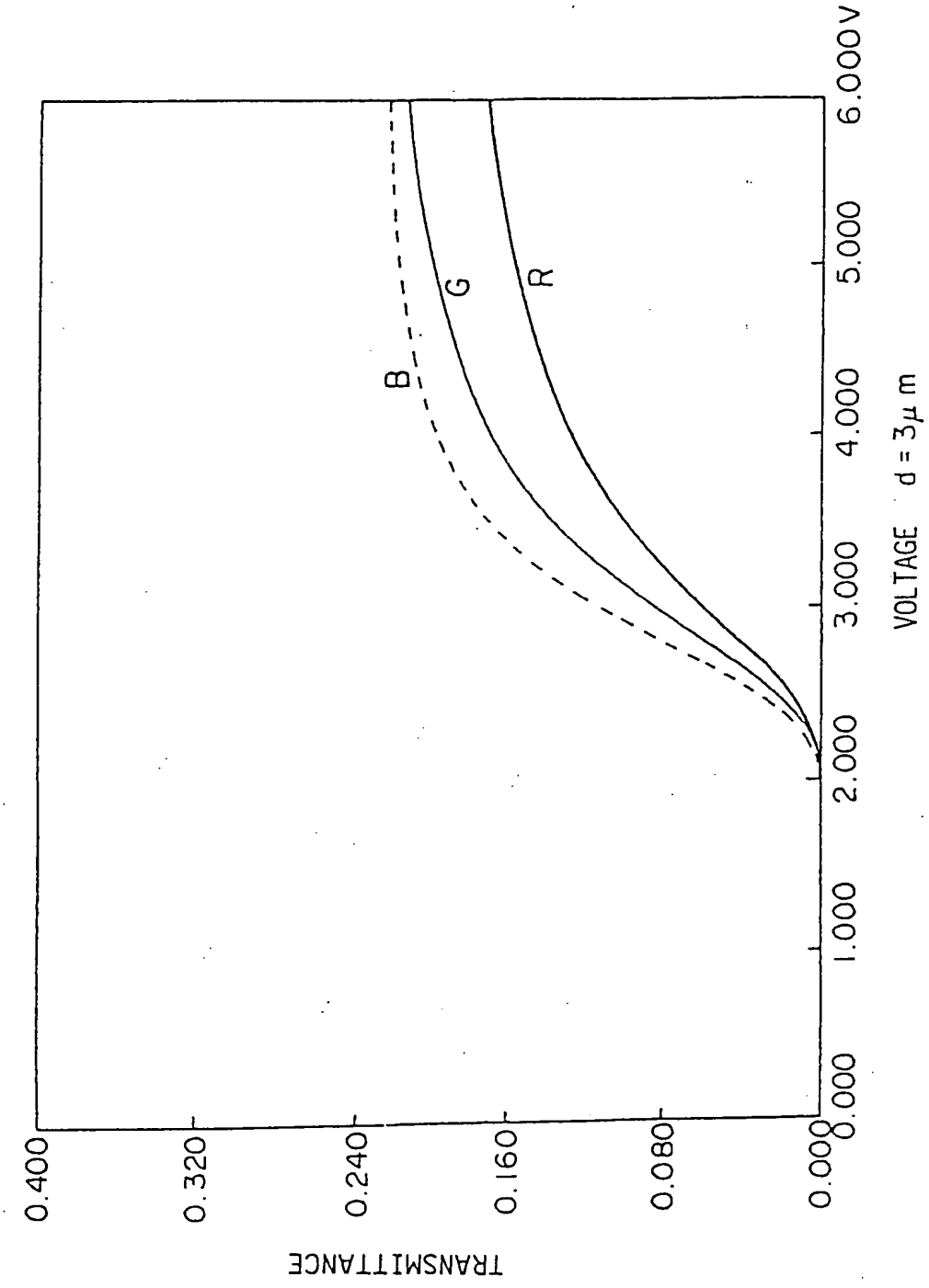

TRANSMITTANCE
0.400
0.320
0.240
0.160
0.080
0.000
0.000
1.000
2.000
3.000
4.000
5.000
6.000V
VOLTAGE d = 3μm
B
G
R

FIG. 26

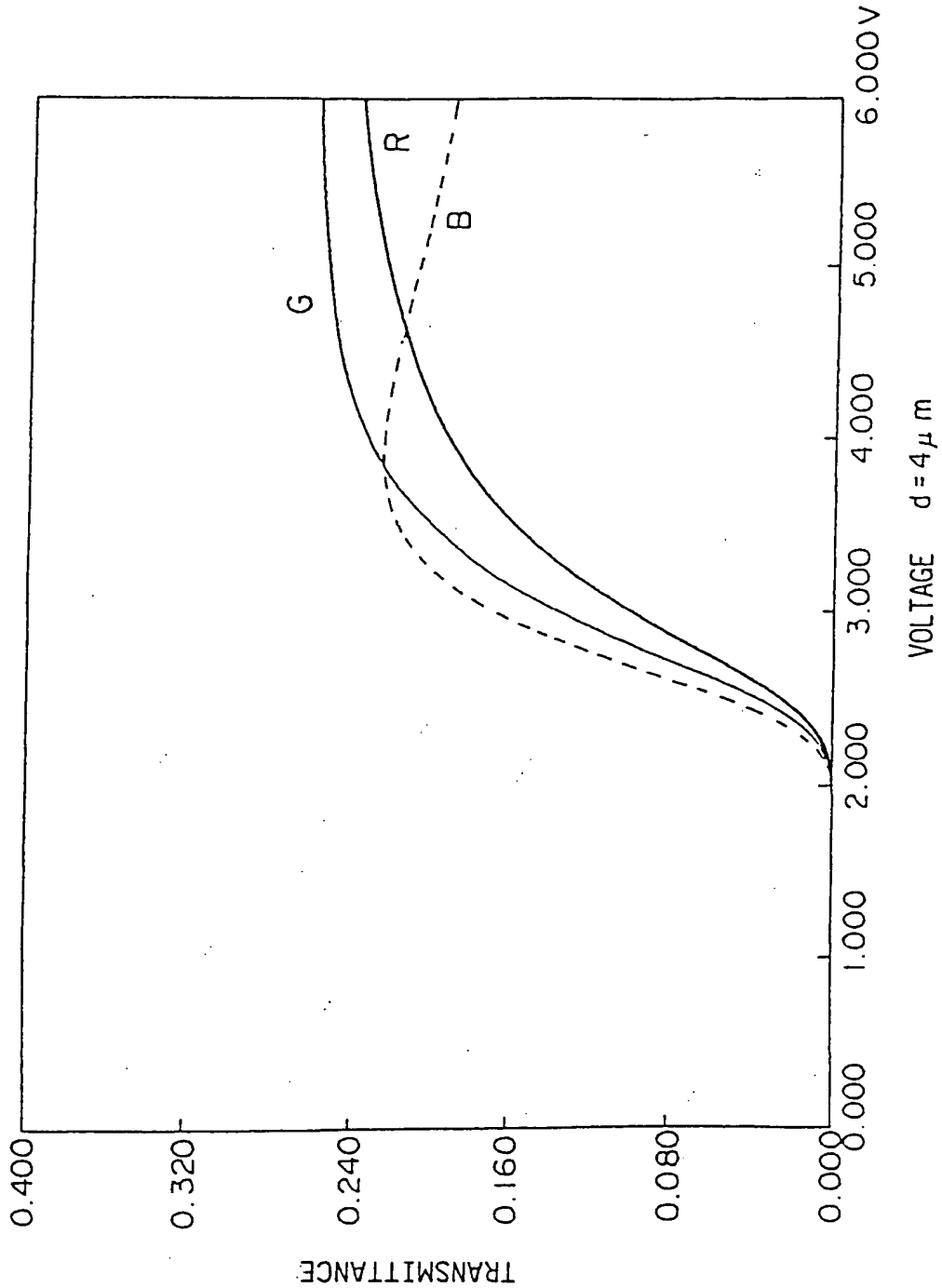

TRANSMITTANCE
0.400
0.320
0.240
0.160
0.080
0.000
0.000
1.000
2.000
3.000
4.000
5.000
6.000V
VOLTAGE d = 4μm
G
R
B

FIG. 27

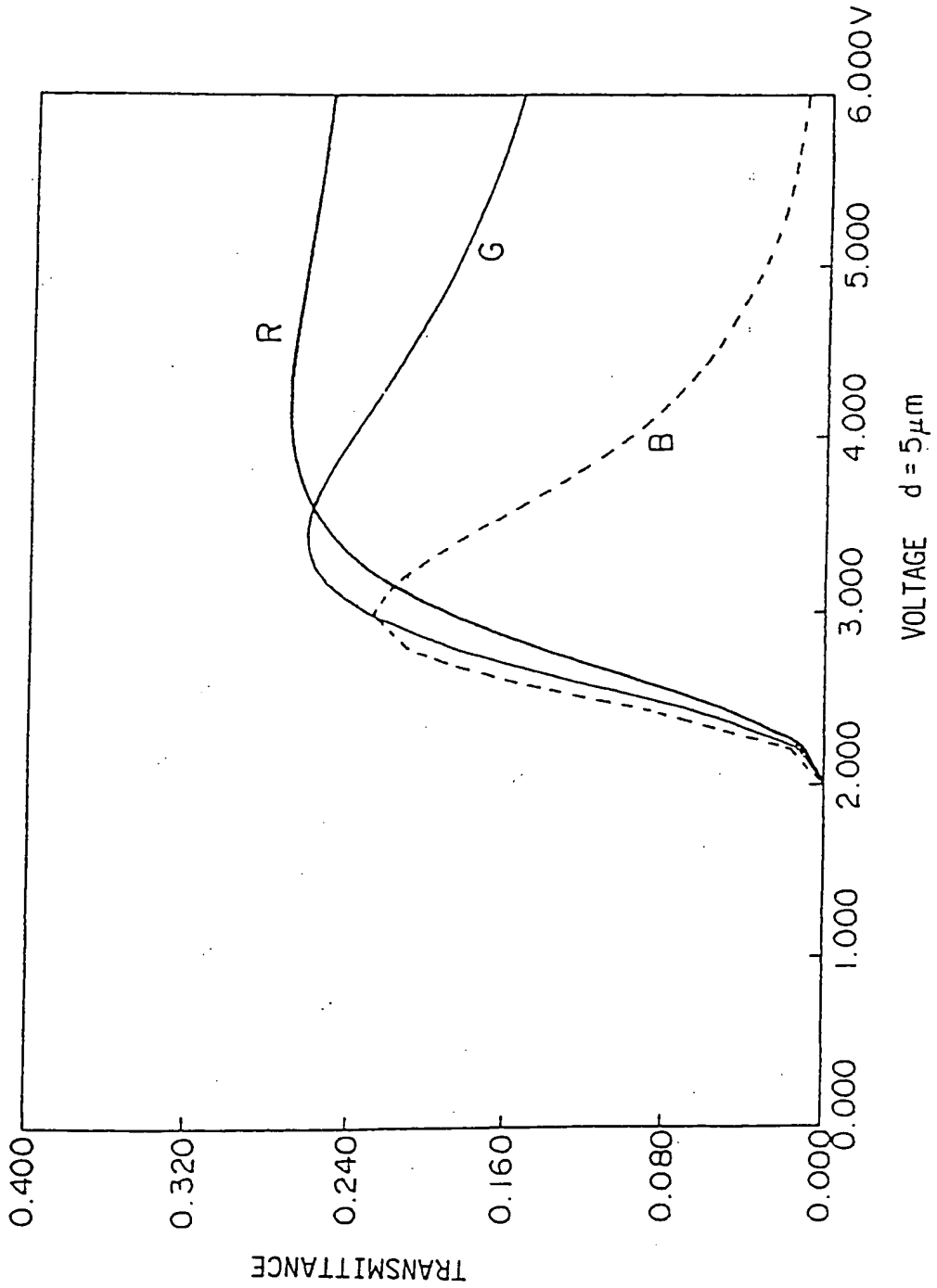

TRANSMITTANCE
0.400
0.320
0.240
0.160
0.080
0.000
0.000
1.000
2.000
3.000
4.000
5.000
6.000V
VOLTAGE d = 5μm
R
G
B

FIG. 28

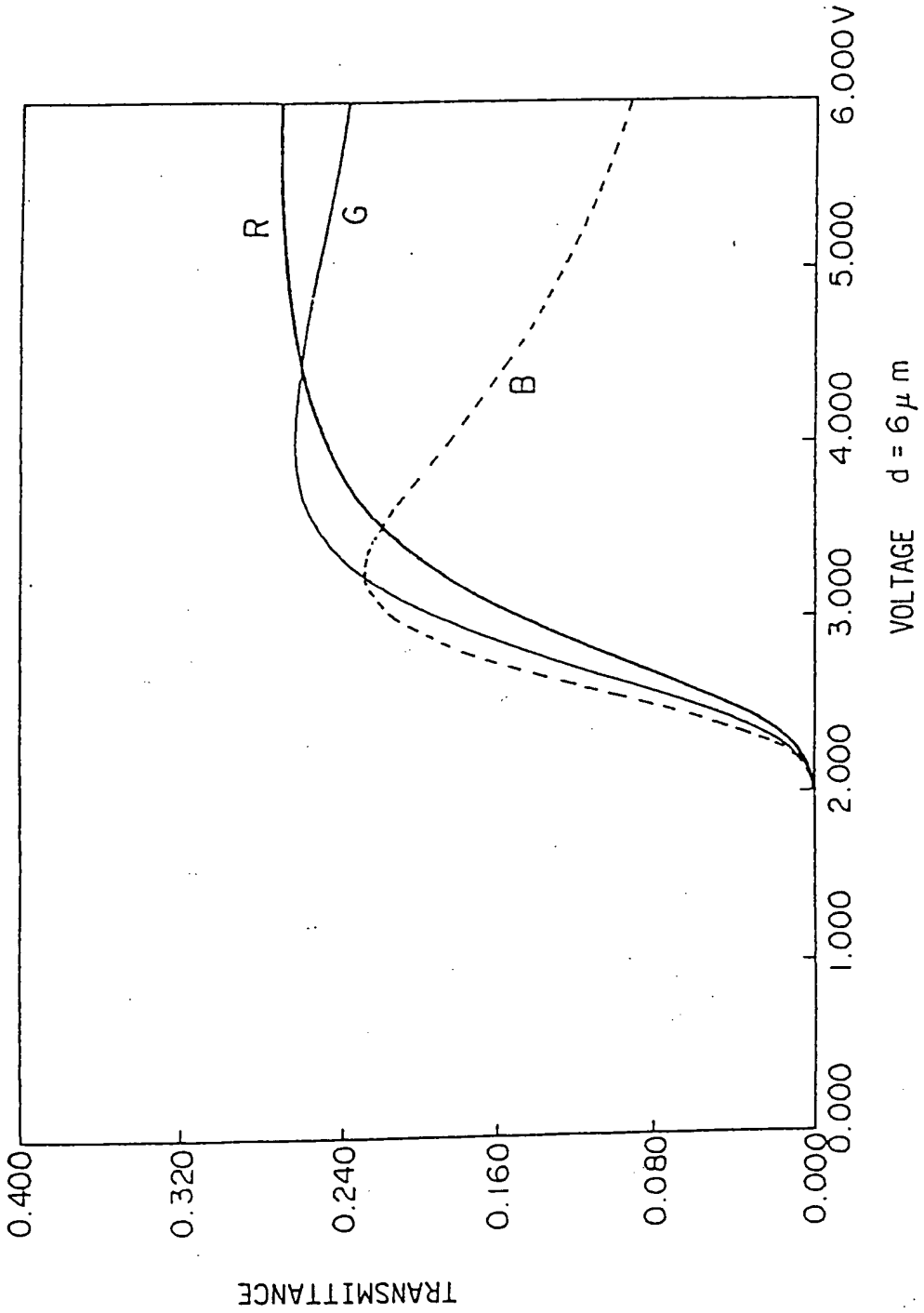
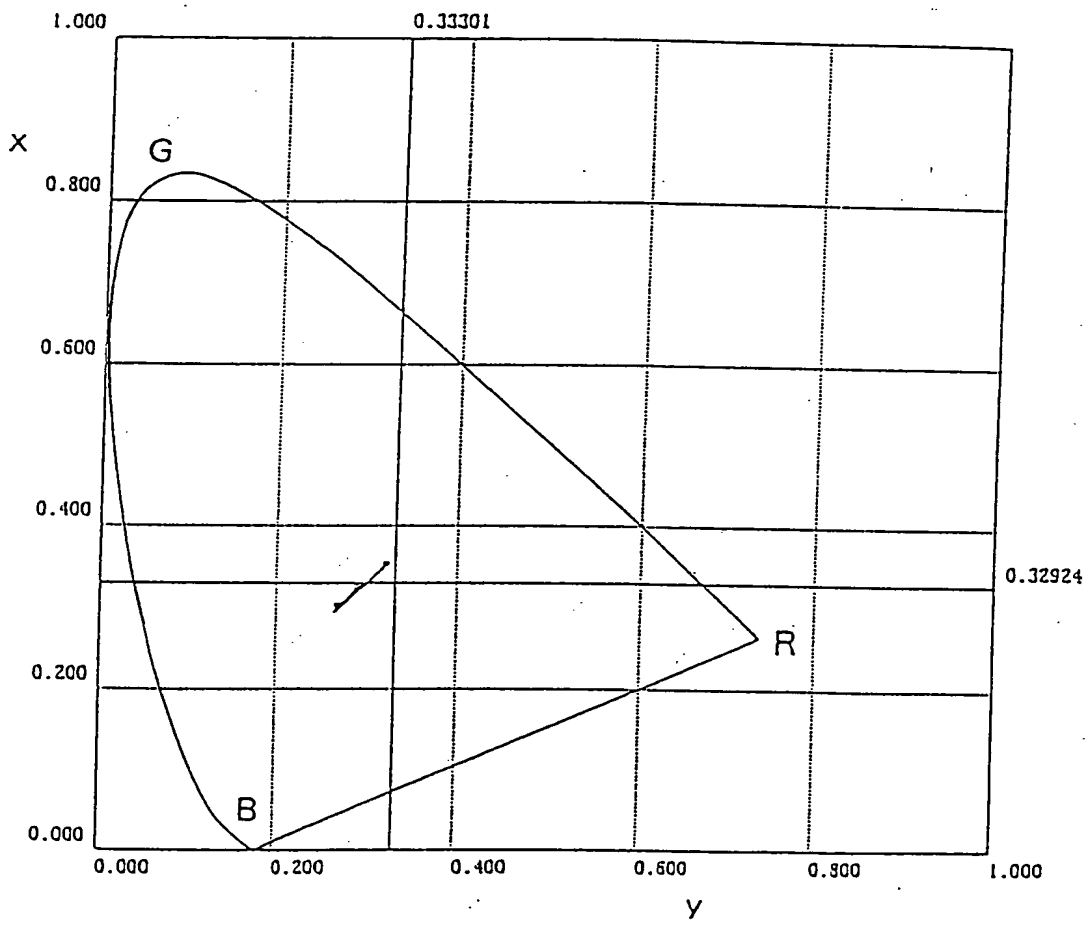
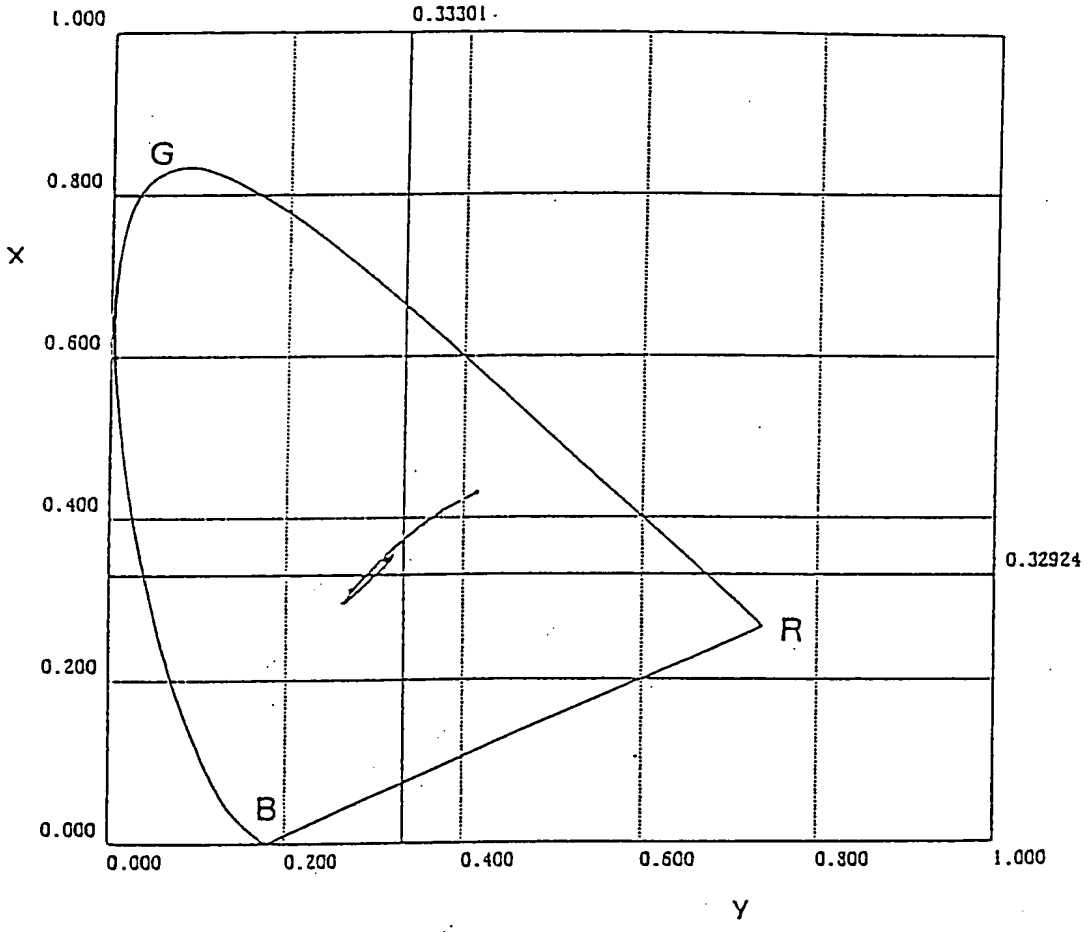

R
G
B
0.400
0.320
0.240
0.160
0.080
0.000
TRANSMITTANCE
0.000
1.000
2.000
3.000
4.000
5.000
6.000 V
VOLTAGE d = 6μm

FIG. 29


1.000
0.33301
X
G
0.800
0.600
0.400
0.32924
R
0.200
B
0.000
0.000
0.200
0.400
0.600
0.800
1.000
y

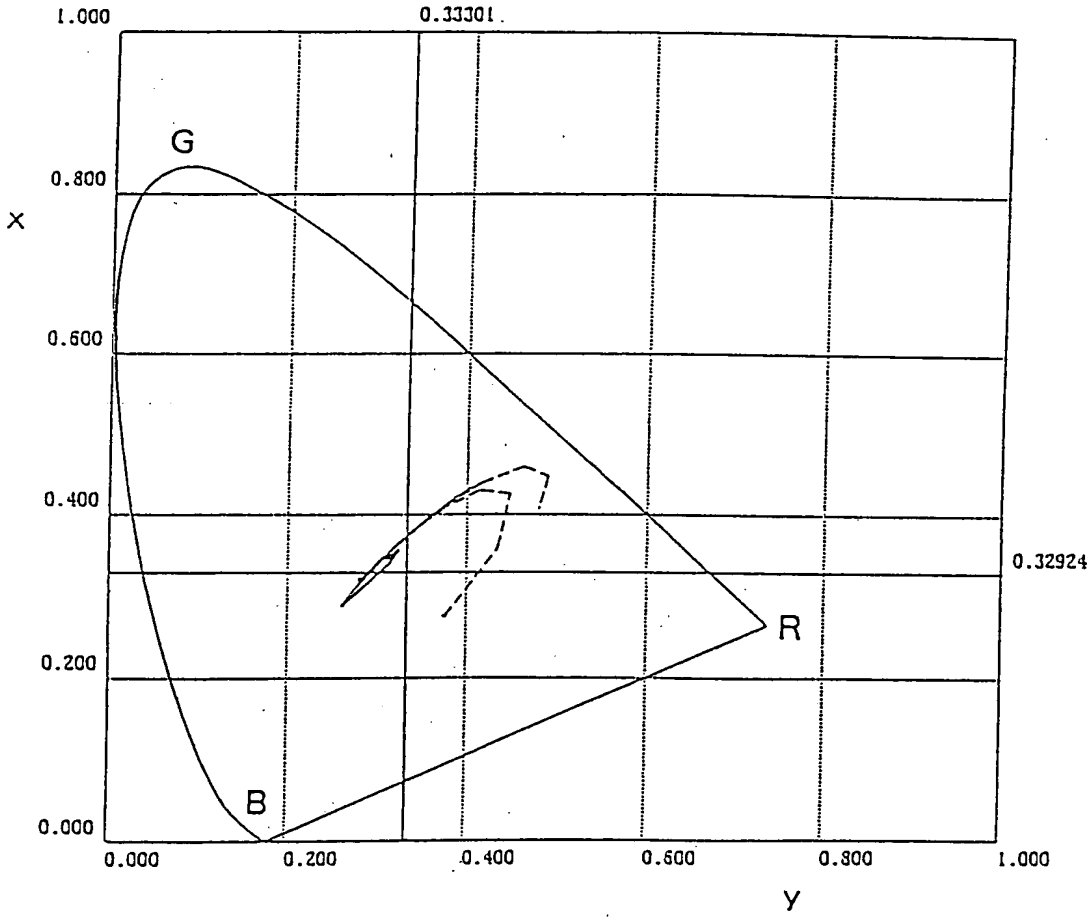
d = 1 μm

FIG. 30


1.000
0.33301
0.800
G
X
0.600
0.400
0.32924
R
0.200
B
0.000
0.000
0.200
0.400
0.600
0.800
1.000
Y

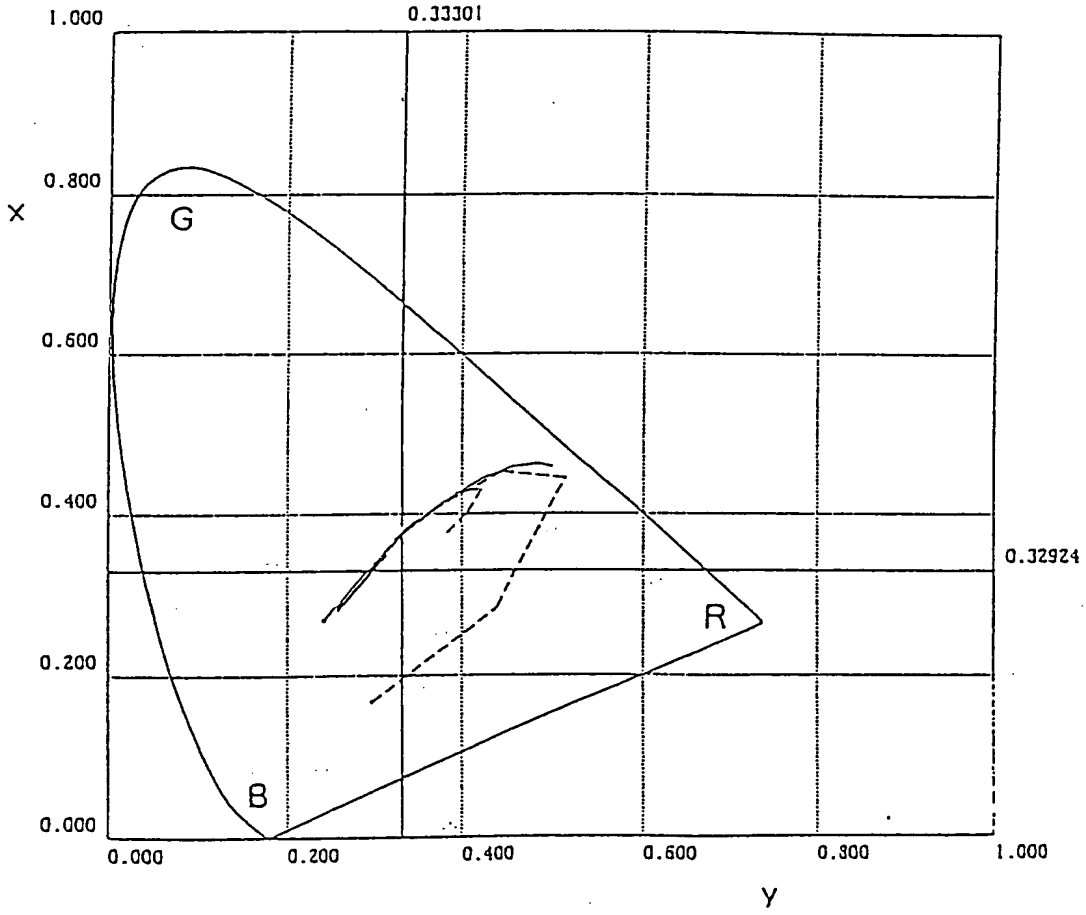
d = 3 μm

FIG. 31


1.000
0.33301
0.800
0.600
0.400
0.32924
0.200
0.000
X
G
R
B
0.000
0.200
0.400
0.600
0.800
1.000
Y

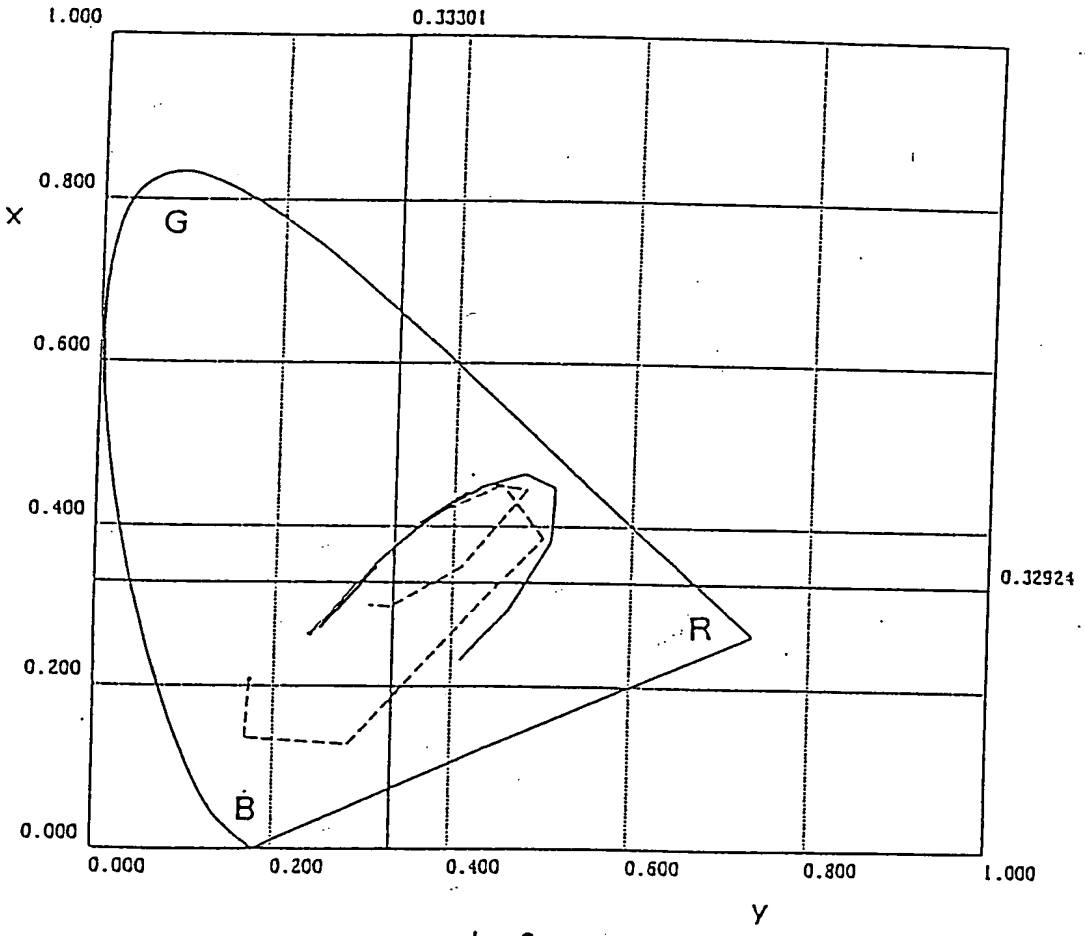
d = 4 μm

FIG. 32


1.000
0.33301
0.800
X
G
0.600
0.400
0.32924
R
0.200
B
0.000
0.000
0.200
0.400
0.600
0.800
1.000
Y

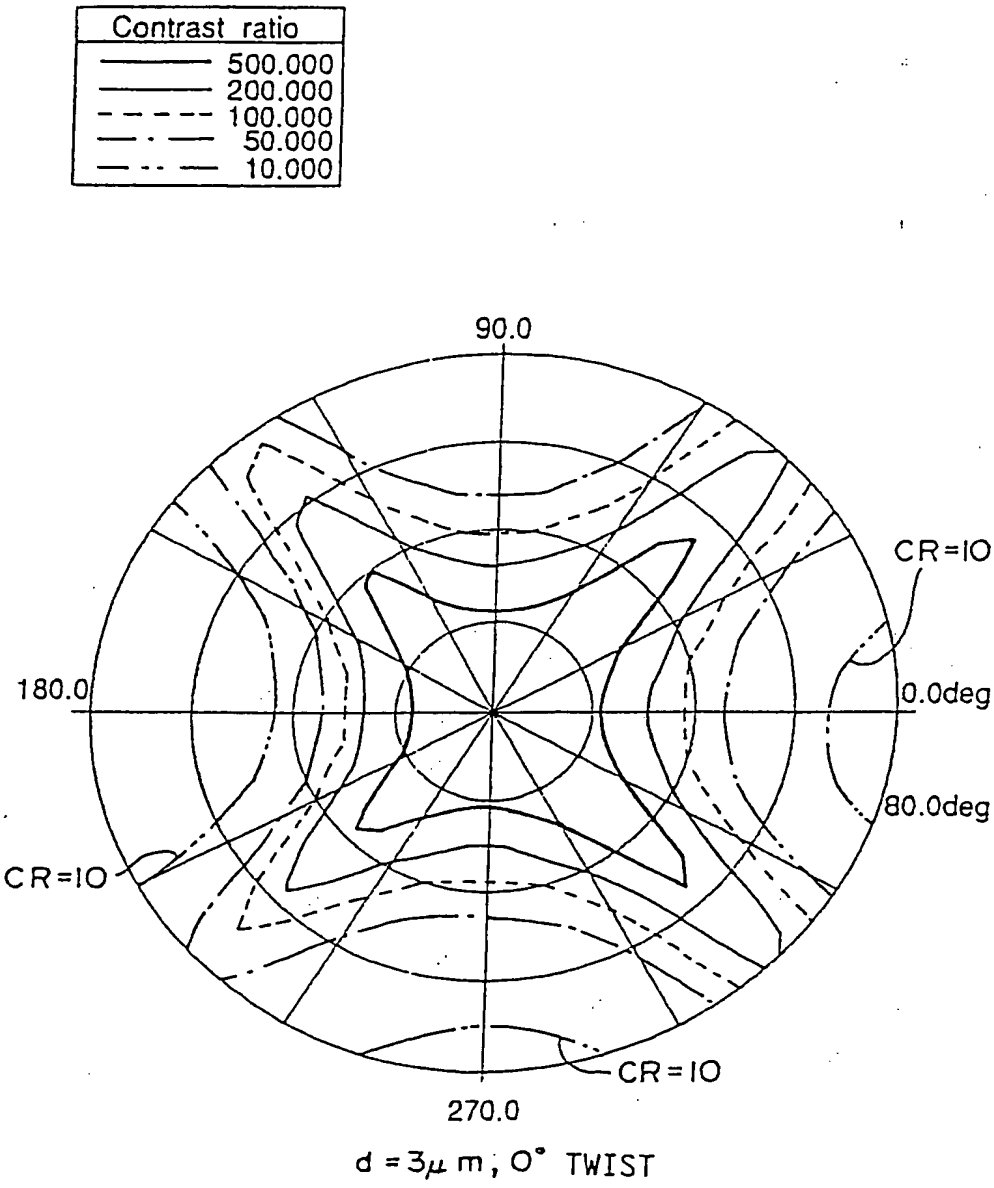
d = 5 μm

FIG. 33


1.000
0.33301
0.800
x
G
0.600
0.400
0.32924
R
0.200
B
0.000
0.000
0.200
0.400
0.600
0.800
1.000
y

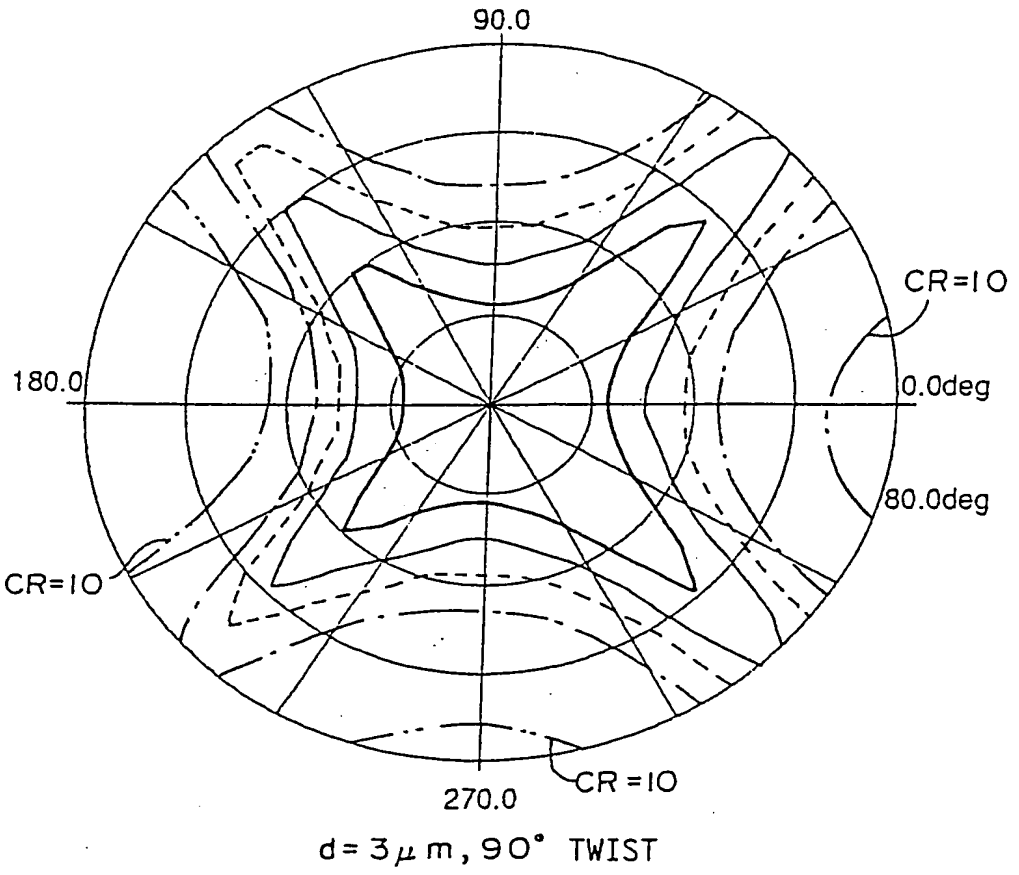
d =6 μm

FIG. 34



d = 3μm, 0° TWIST

FIG. 35



d=3μm, 90° TWIST

FIG. 36

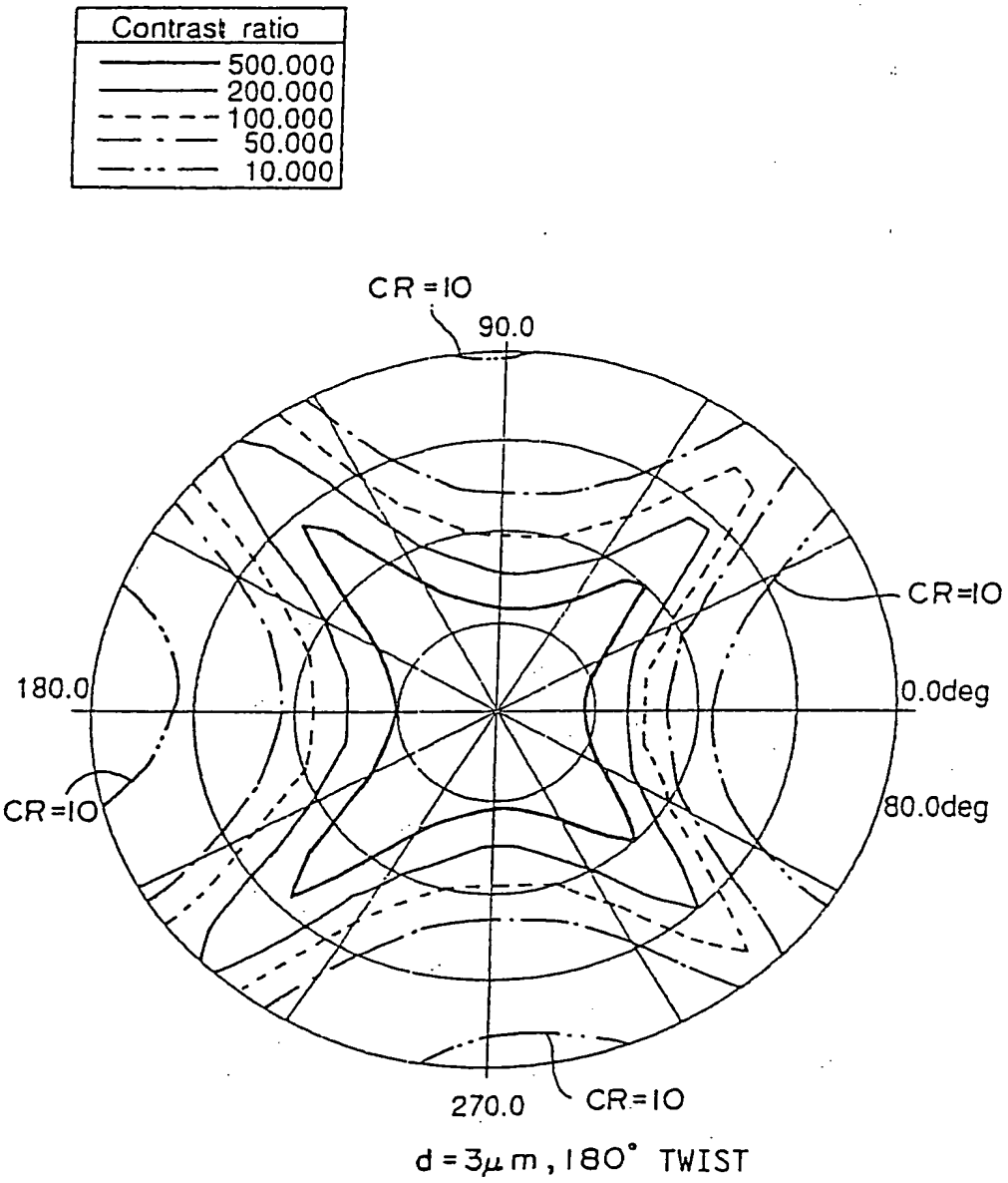
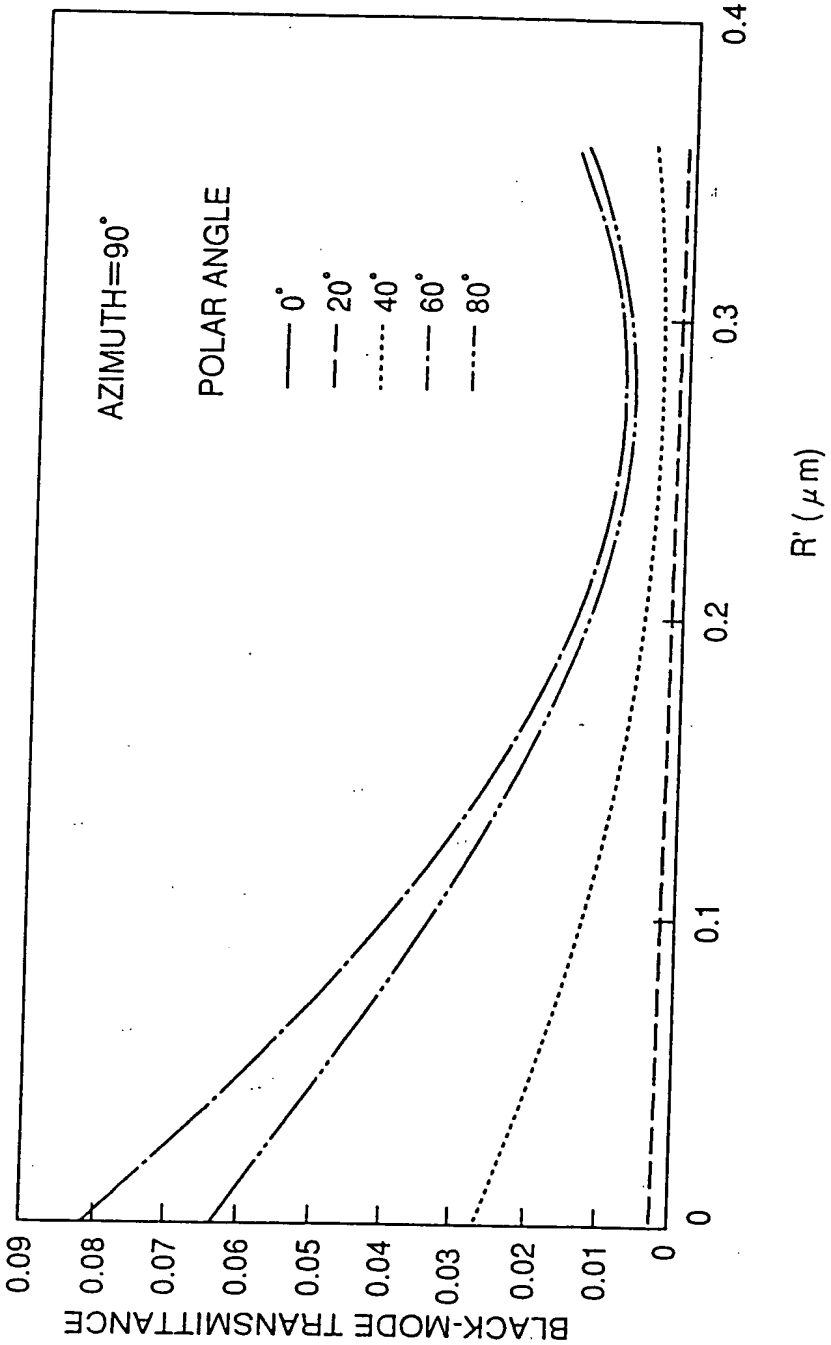

Contrast ratio
500.000
200.000
100.000
50.000
10.000
CR=10
90.0
CR=10
180.0
0.0deg
CR=10
80.0deg
270.0
CR=10
d=3μm, 180° TWIST

FIG.37


AZIMUTH=90°
POLAR ANGLE
0°
20°
40°
60°
80°
BLACK-MODE TRANSMITTANCE
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
0.1
0.2
0.3
0.4
R' (μm)

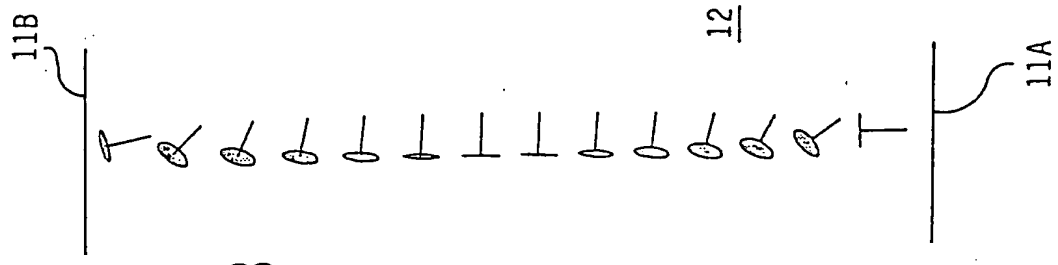


FIG. 38B

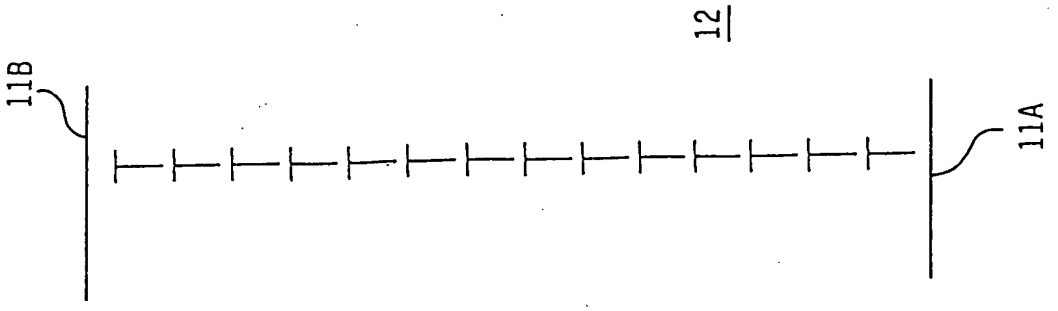


FIG. 38A

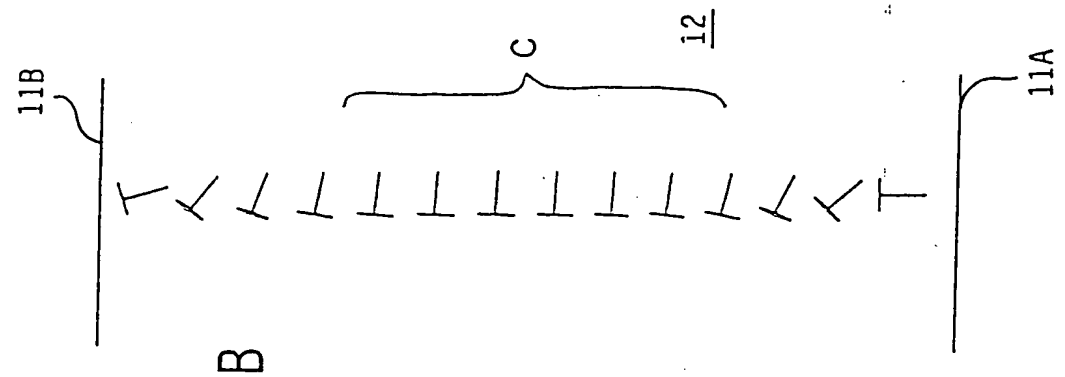


FIG. 39B

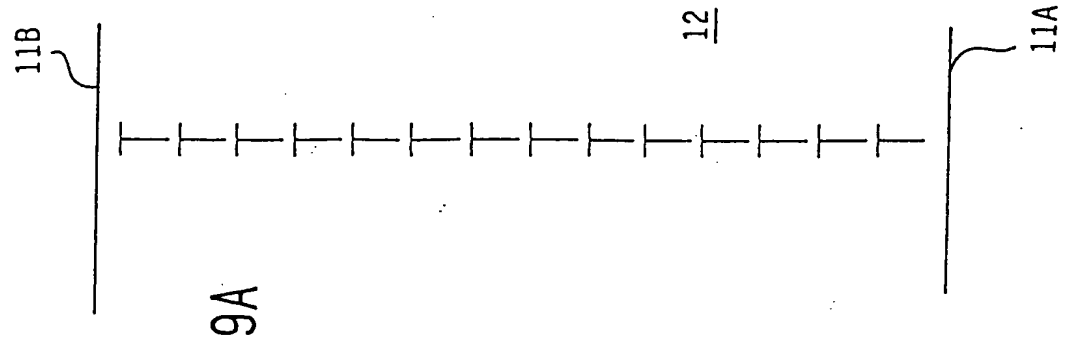
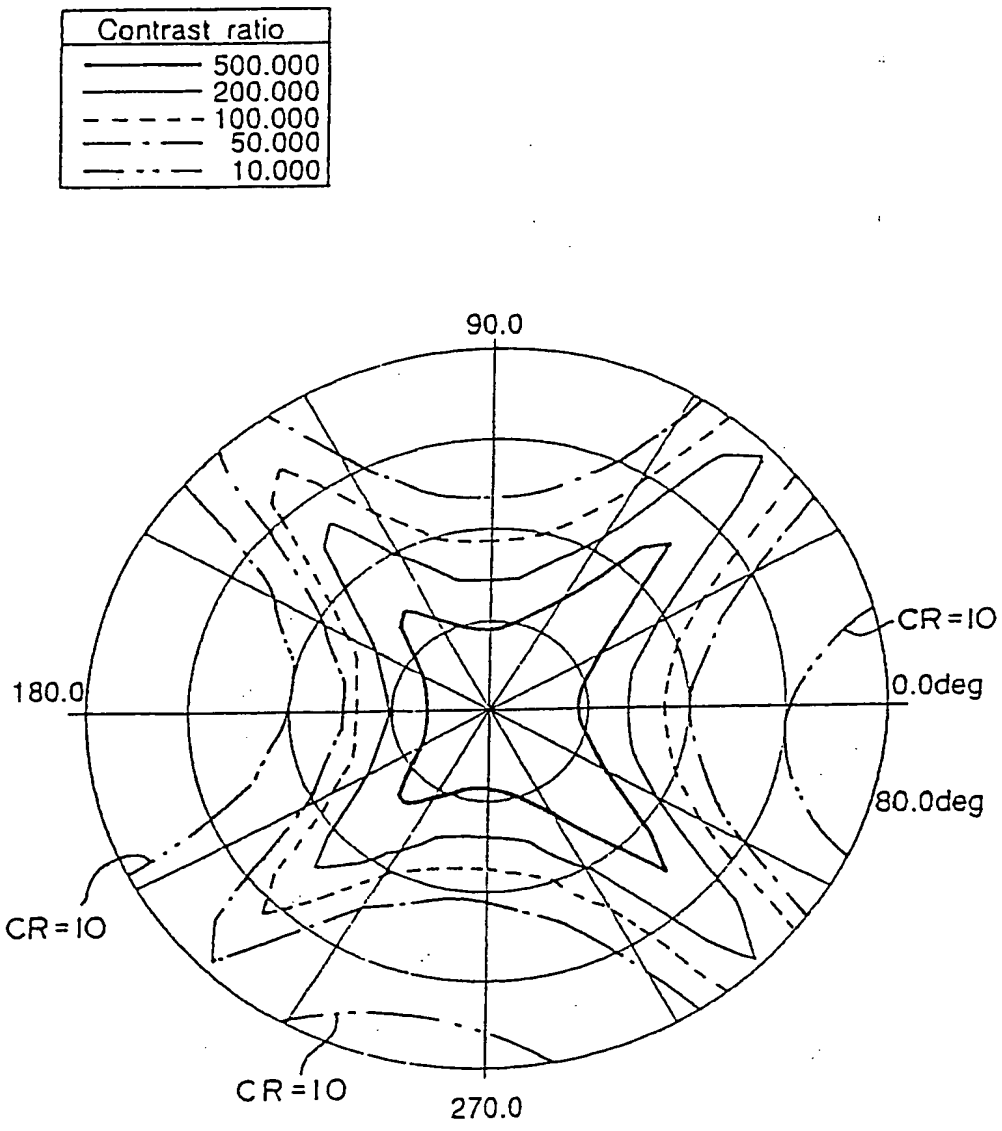


FIG. 39A

FIG. 40



d = 3μm, 90° TWIST

FIG. 41

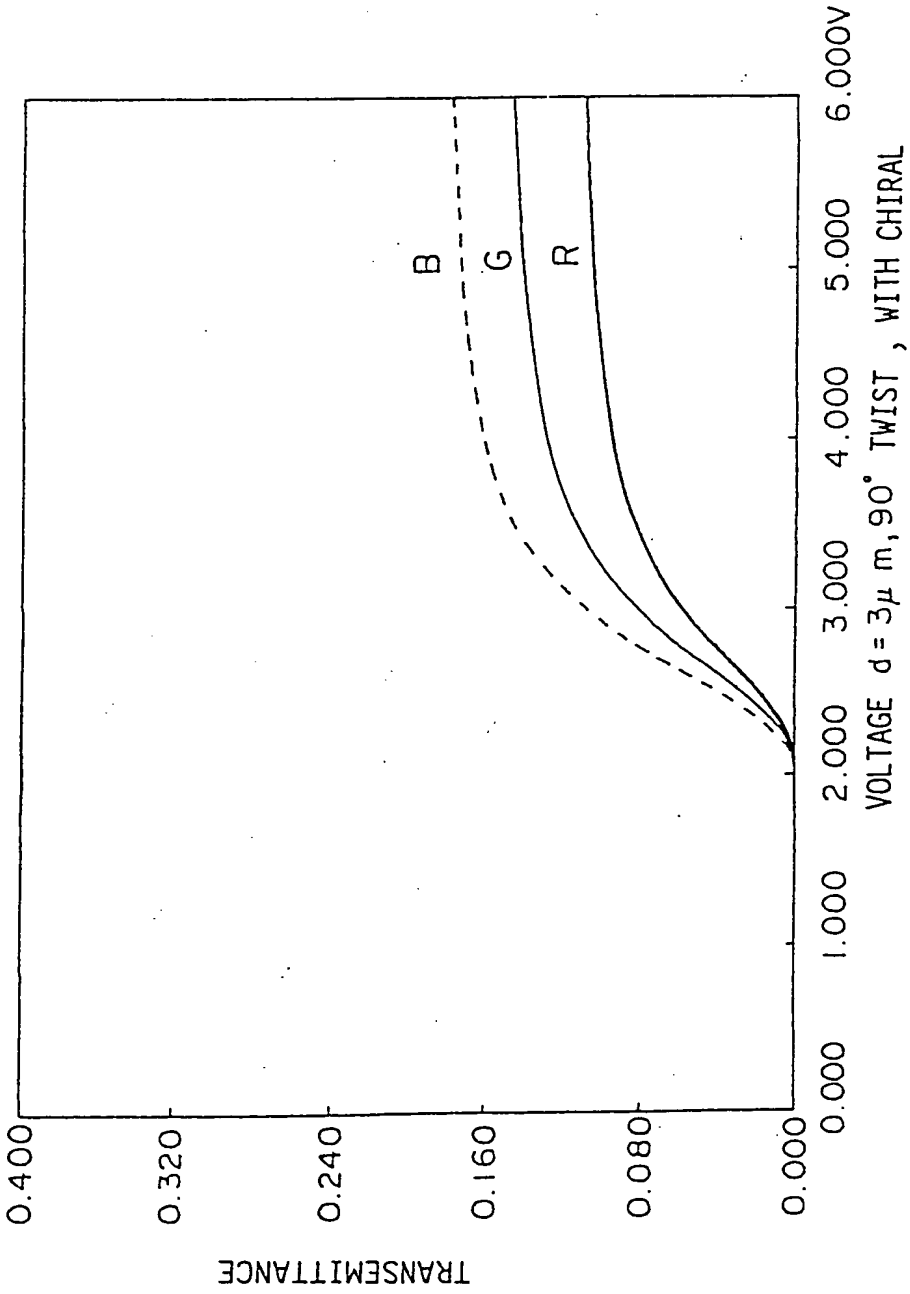

TRANSEMITTANCE
0.400
0.320
0.240
0.160
0.080
0.000
0.000
1.000
2.000
3.000
4.000
5.000
6.000V
VOLTAGE d = 3μ m, 90° TWIST , WITH CHIRAL
B
G
R

FIG. 42

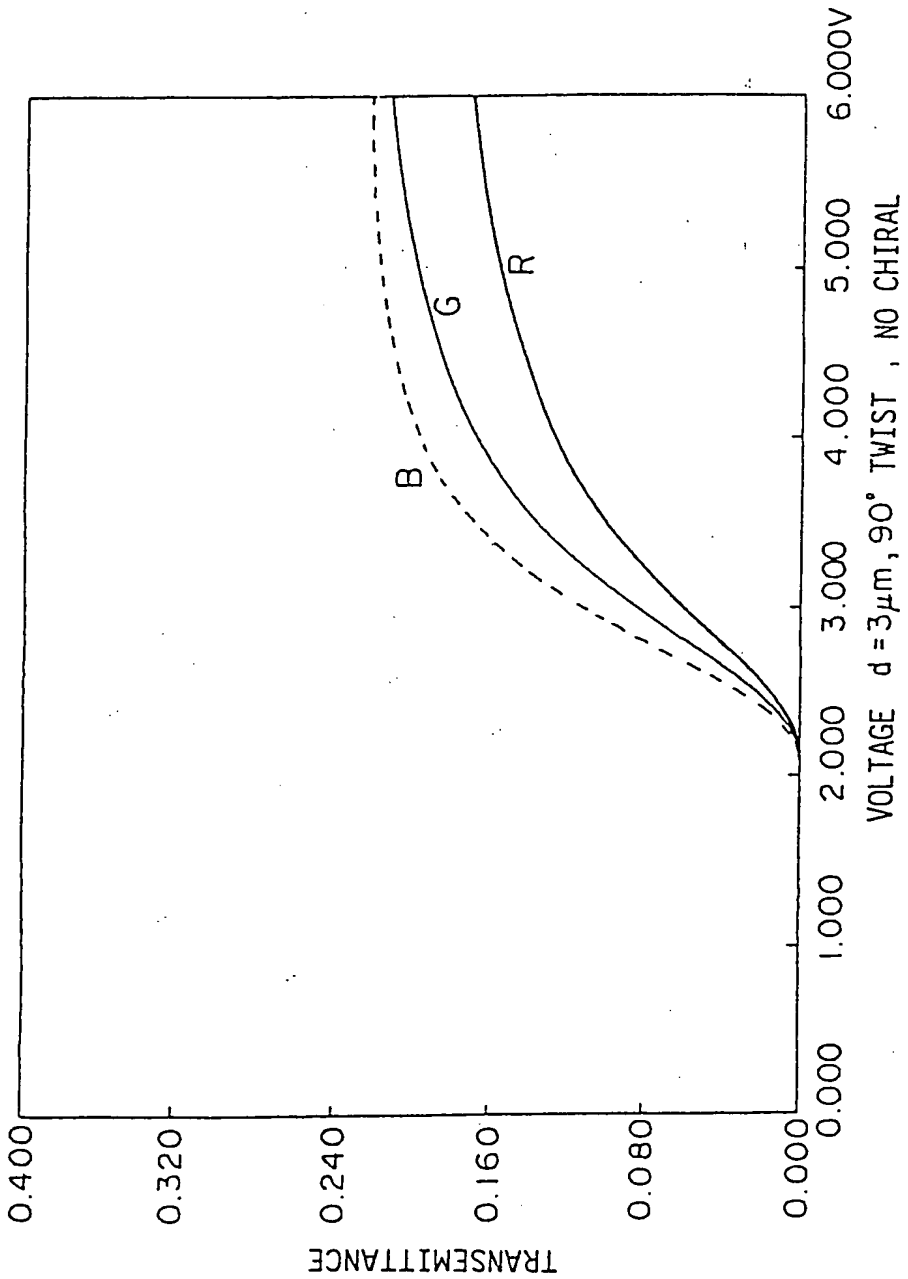
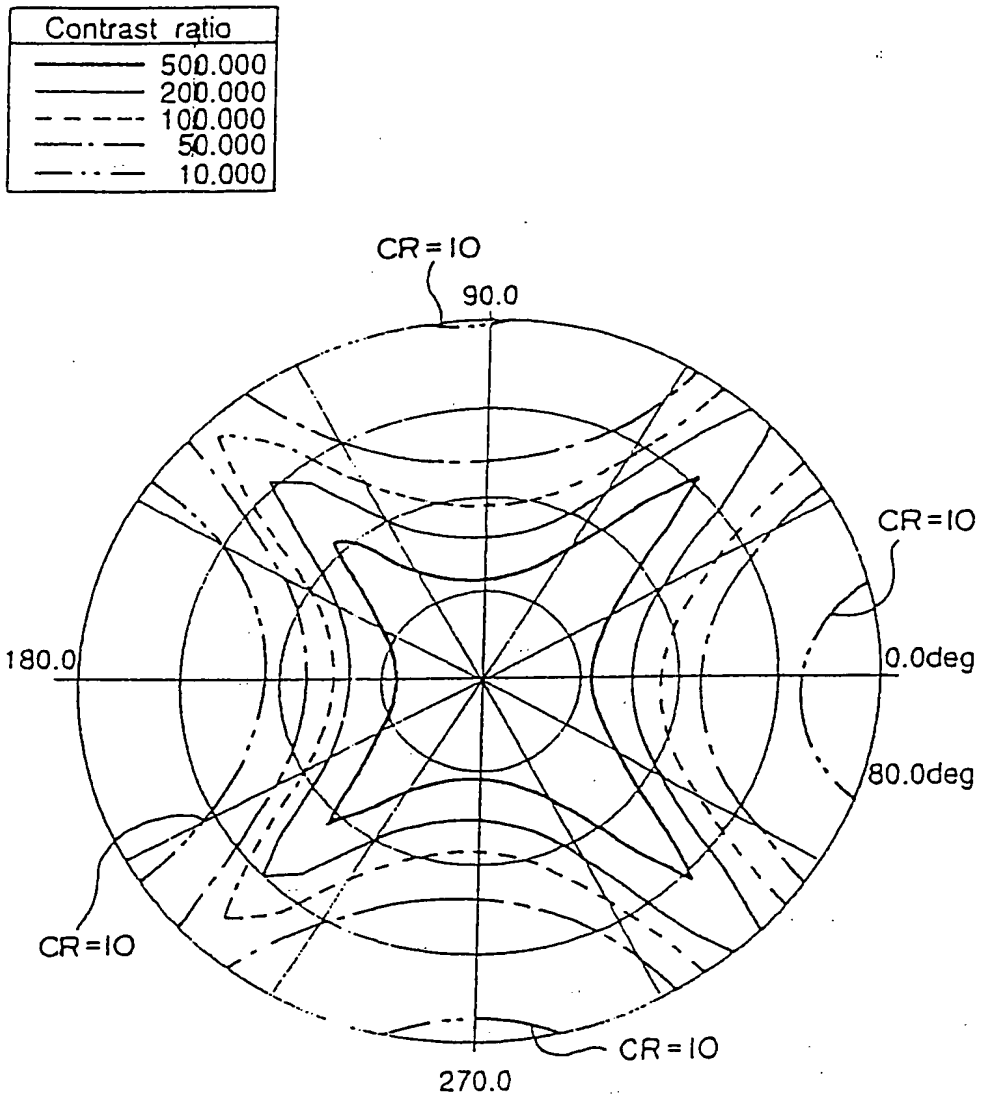
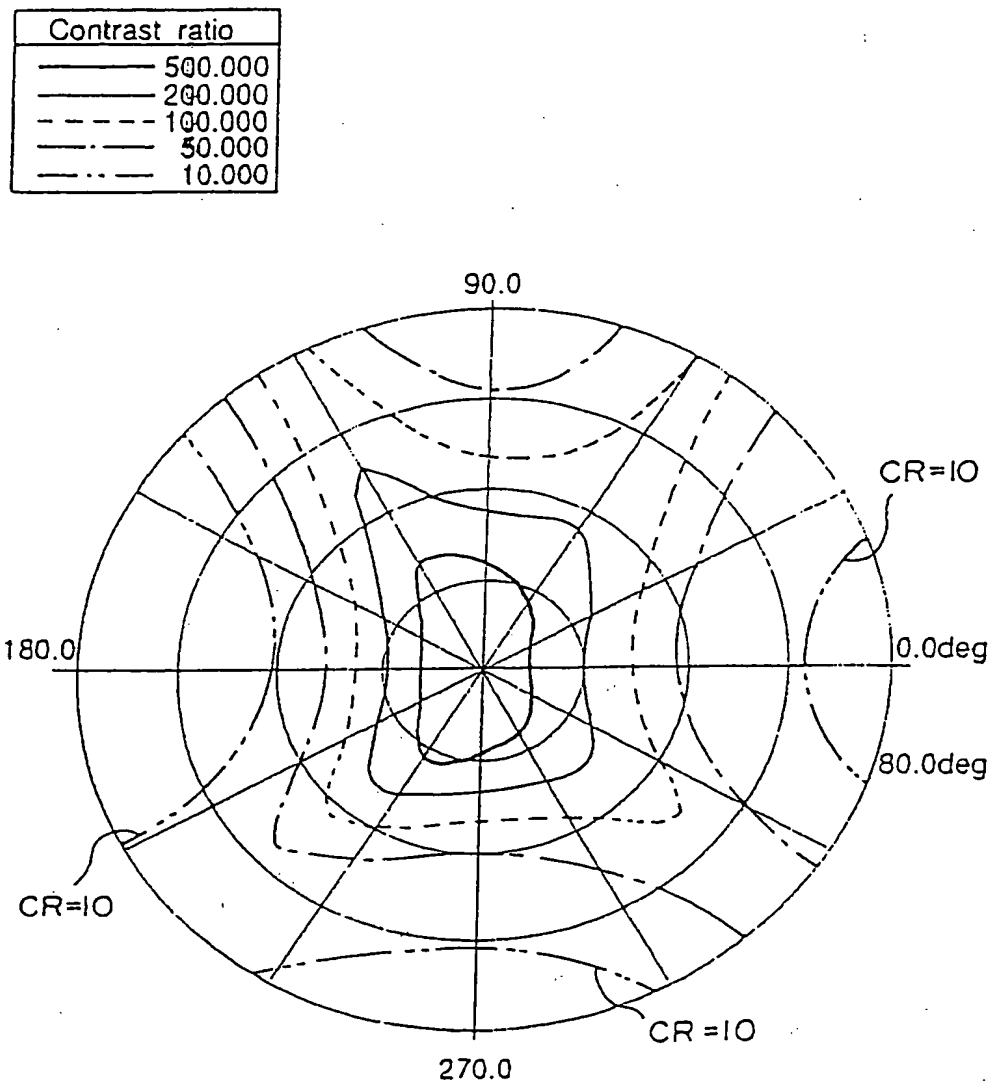

TRANSEMITTANCE
0.400
0.320
0.240
0.160
0.080
0.000
0.000
1.000
2.000
3.000
4.000
5.000
6.000V
VOLTAGE d=3μm, 90° TWIST , NO CHIRAL
B
G
R

FIG. 43



PRETILT= 89.99°
CELL= 3μm, 45° TWIST

FIG. 44



PRETILT= 85°

CELL= 3μm, 45° TWIST

FIG. 45

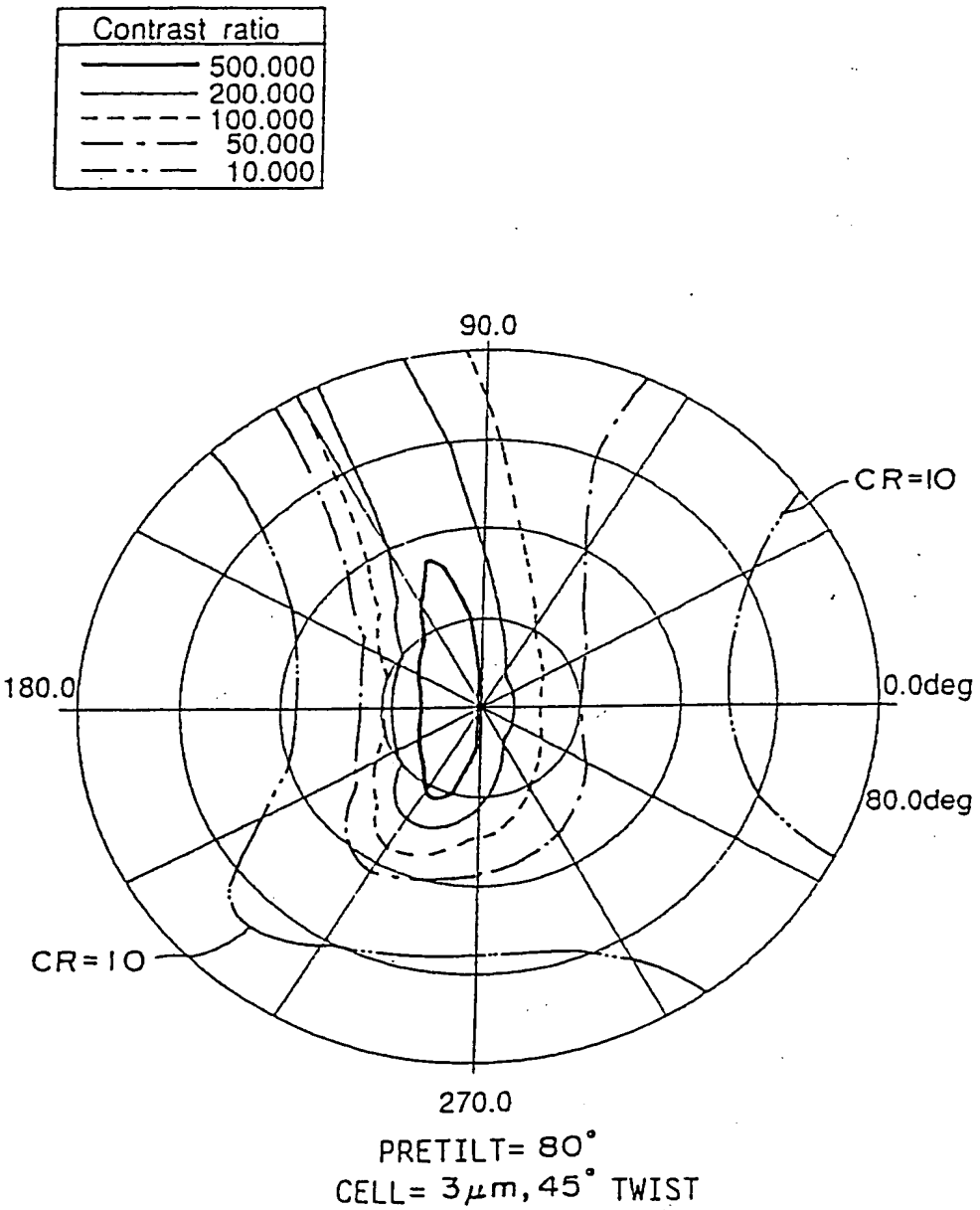

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
CR=10
180.0
0.0deg
80.0deg
CR=10
270.0
PRETILT= 80°
CELL= 3μm, 45° TWIST

FIG. 46

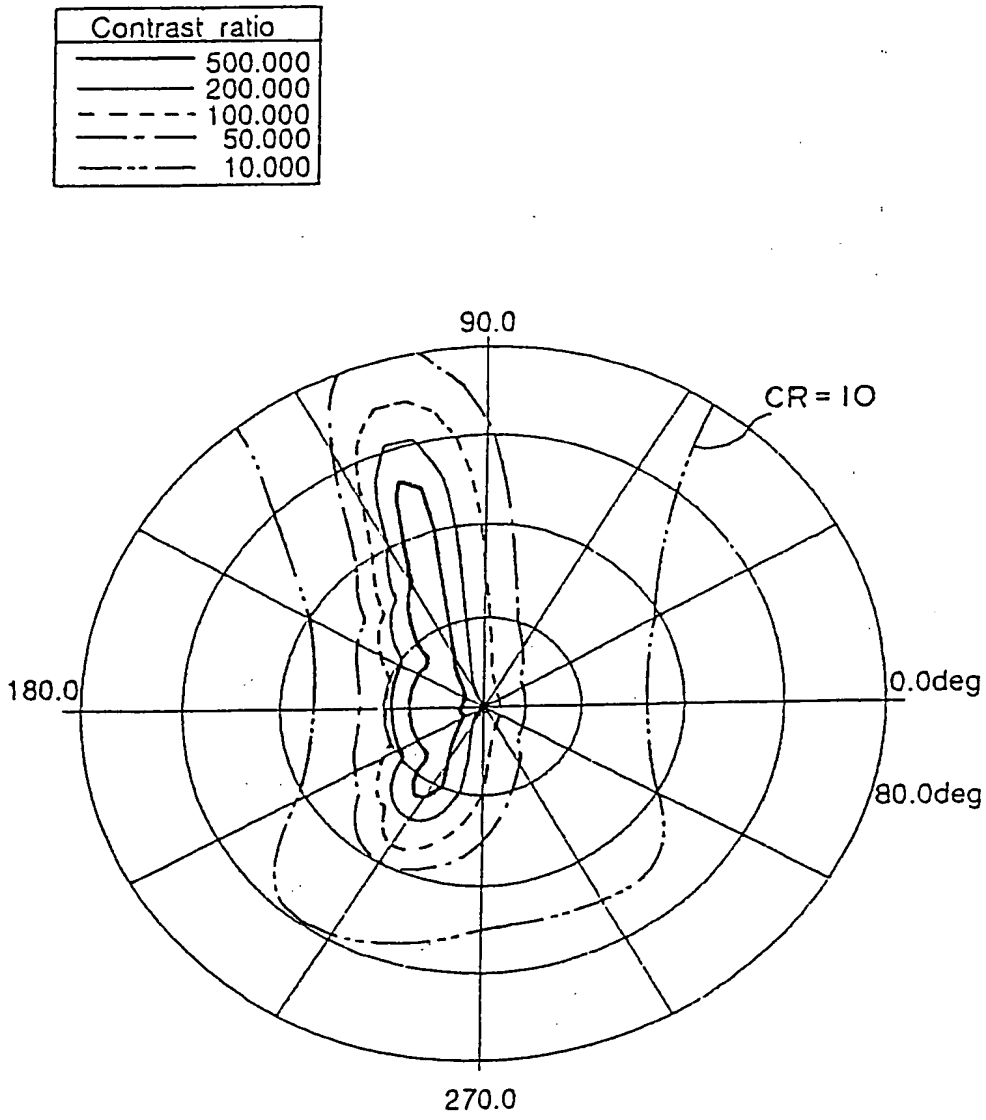

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
CR = 10
180.0
0.0deg
80.0deg
270.0
PRETILT= 75°
CELL= 3μ m ,45° TWIST

FIG. 47
PRIOR ART

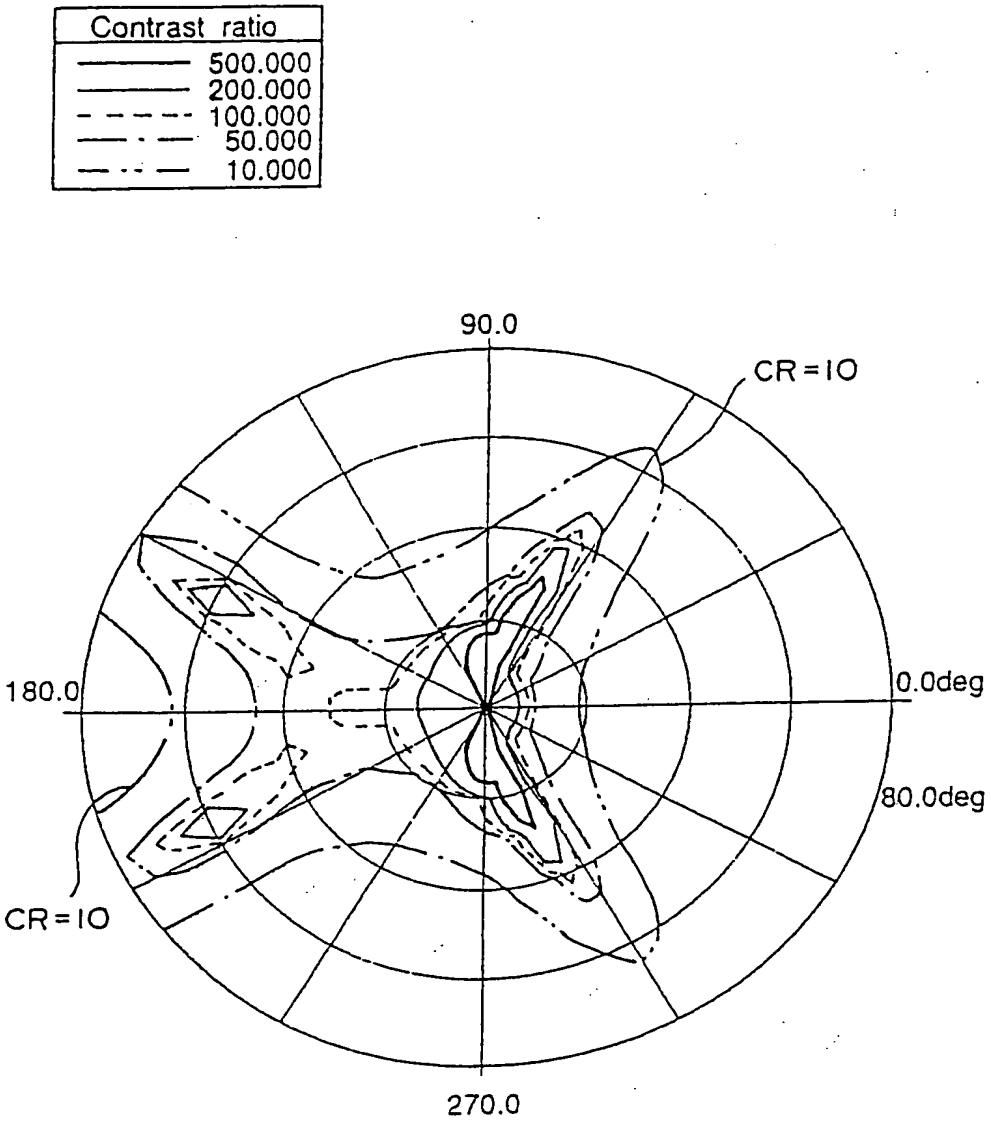


FIG. 48

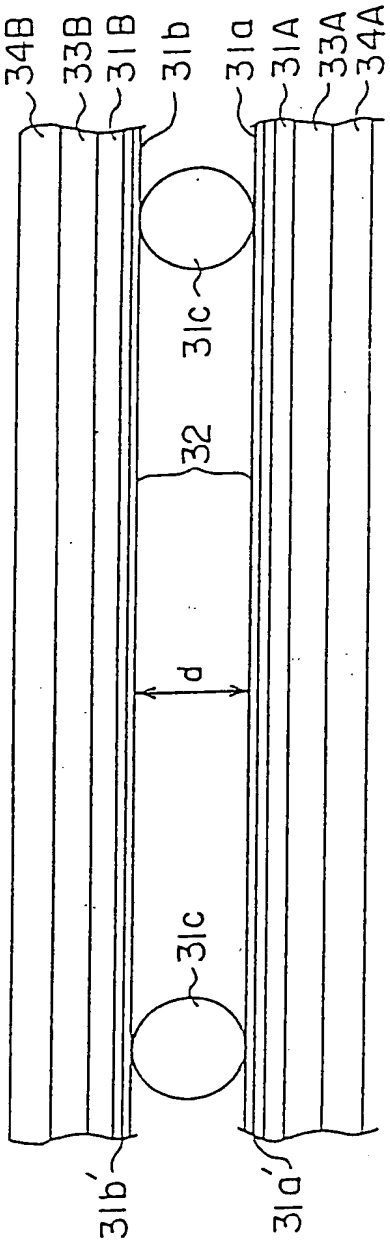


FIG. 49A

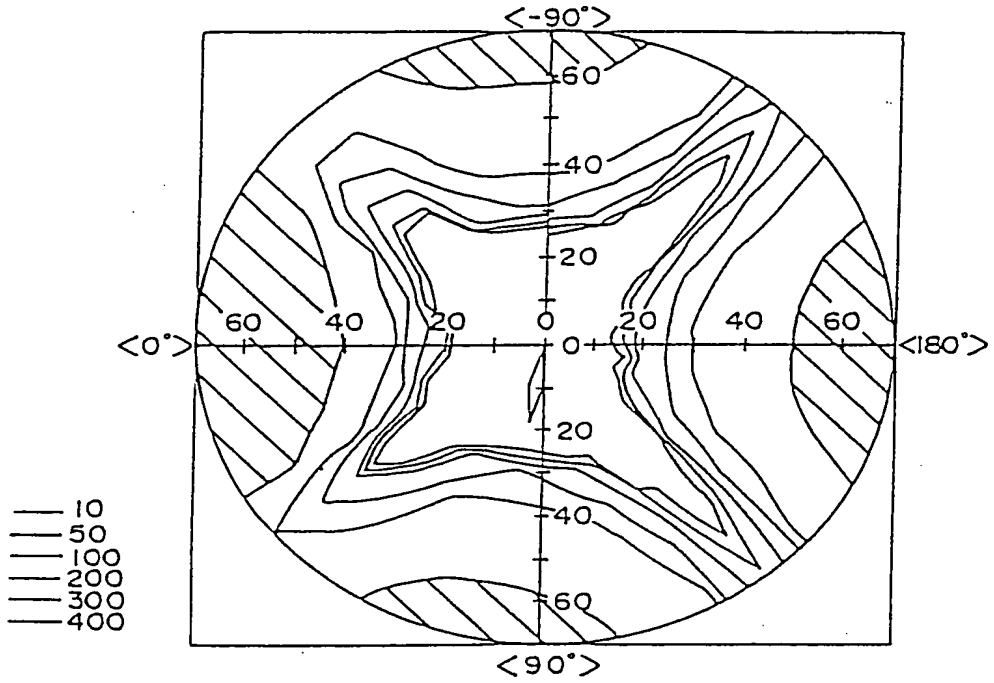


FIG. 49B

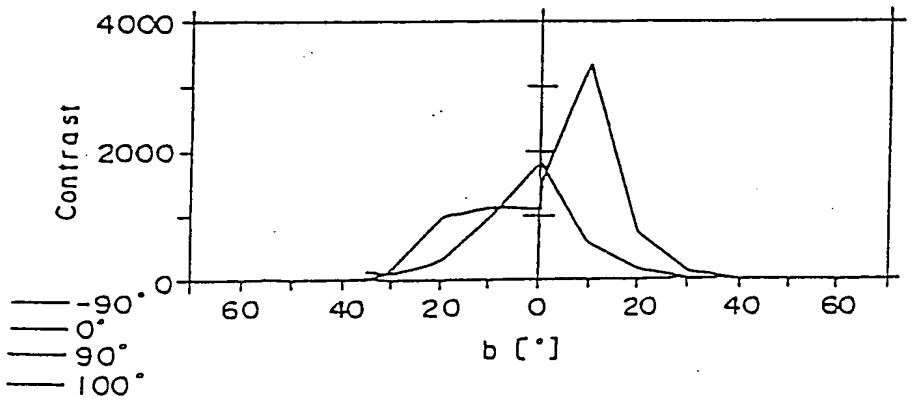


FIG. 50A

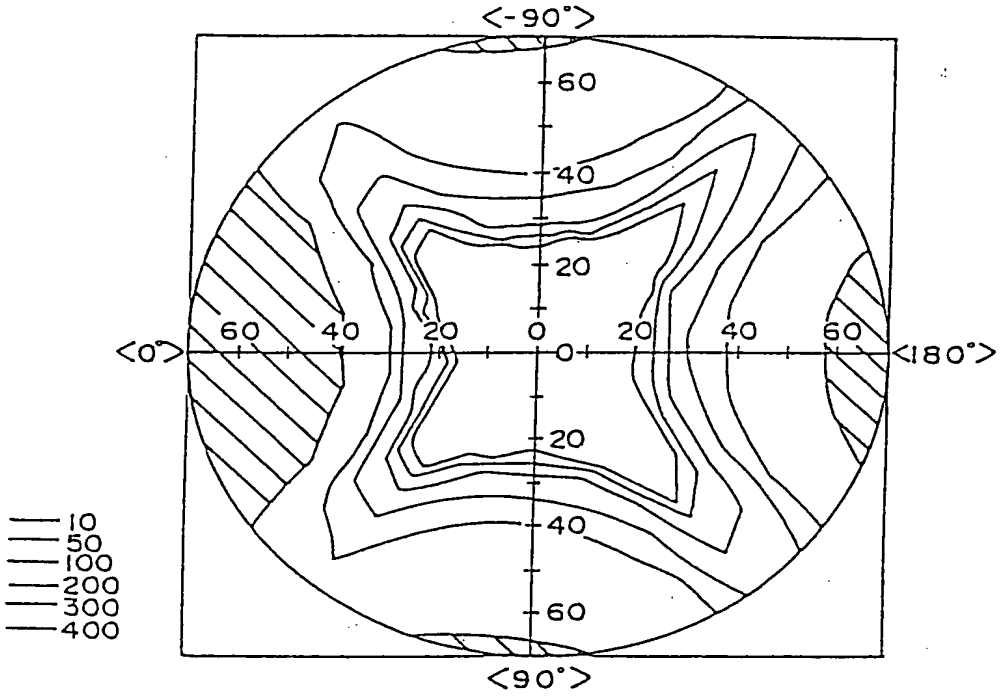


FIG. 50B

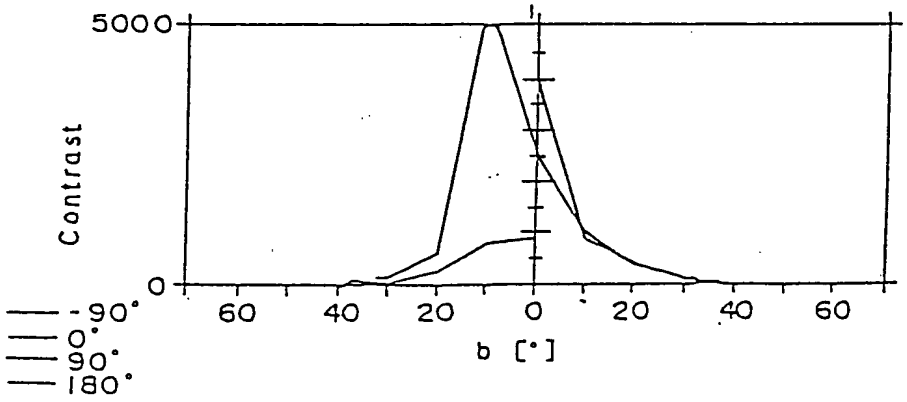
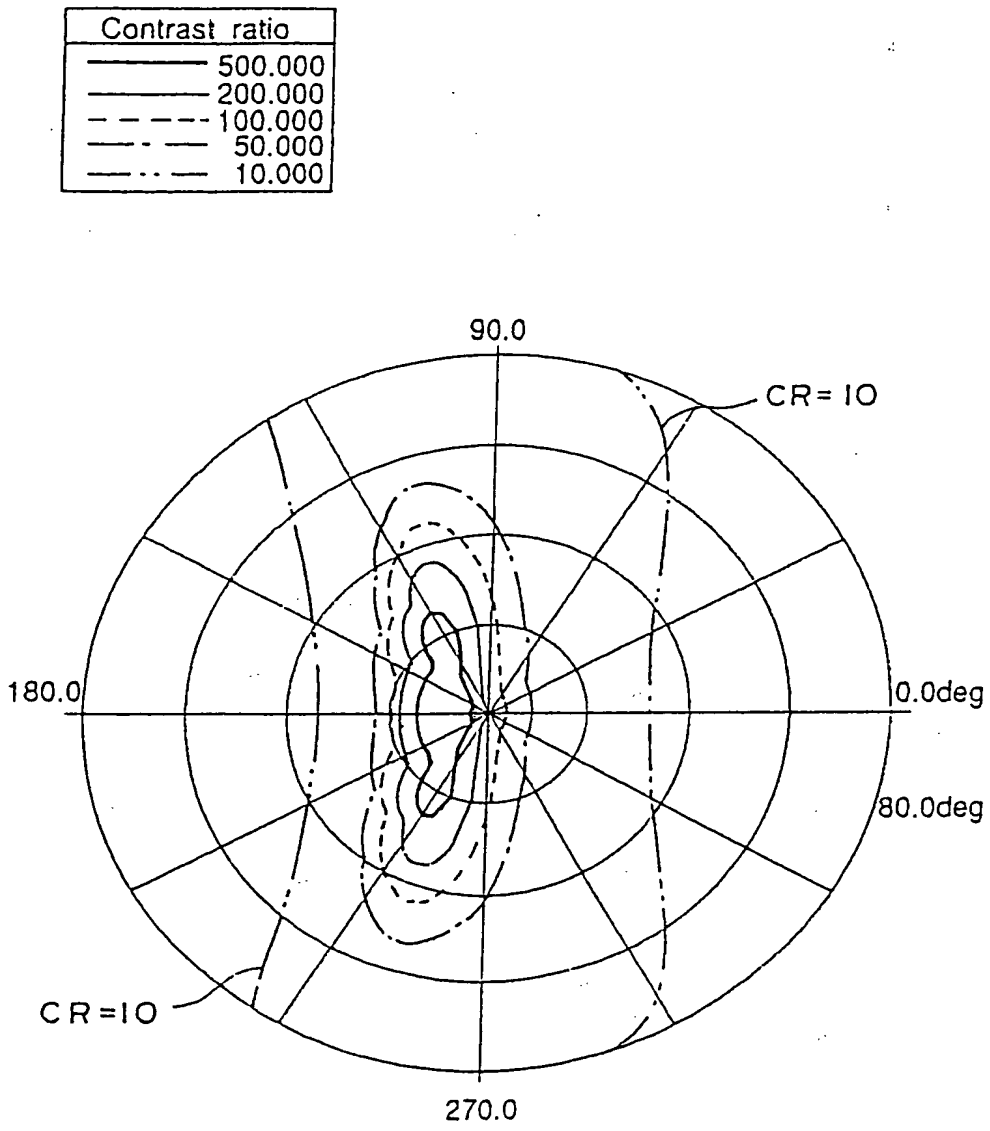


FIG. 51



PRITILT= 75°
CELL= 3μm, 45° TWIST

FIG. 52

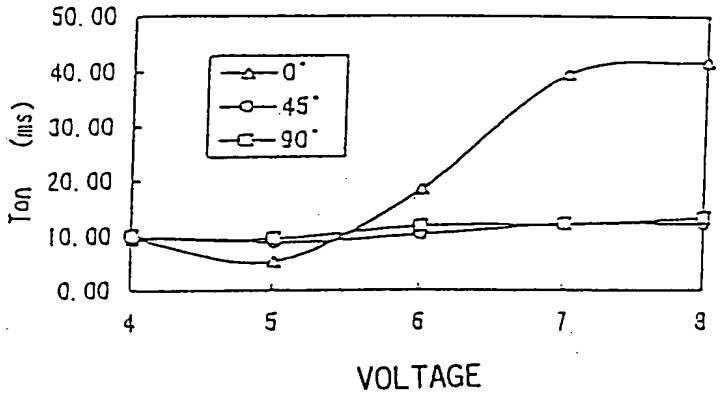

50.00
40.00
30.00
20.00
10.00
0.00
Ton (ms)
0°
45°
90°
4
5
6
7
8
VOLTAGE

FIG. 53

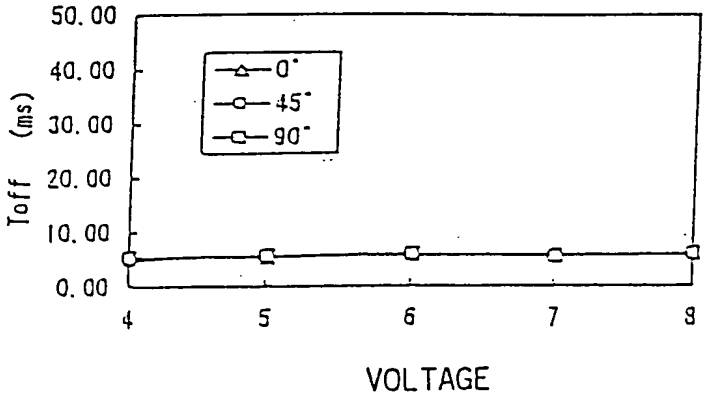

50.00
40.00
30.00
20.00
10.00
0.00
Toff (ms)
0°
45°
90°
4
5
6
7
8
VOLTAGE

FIG. 54

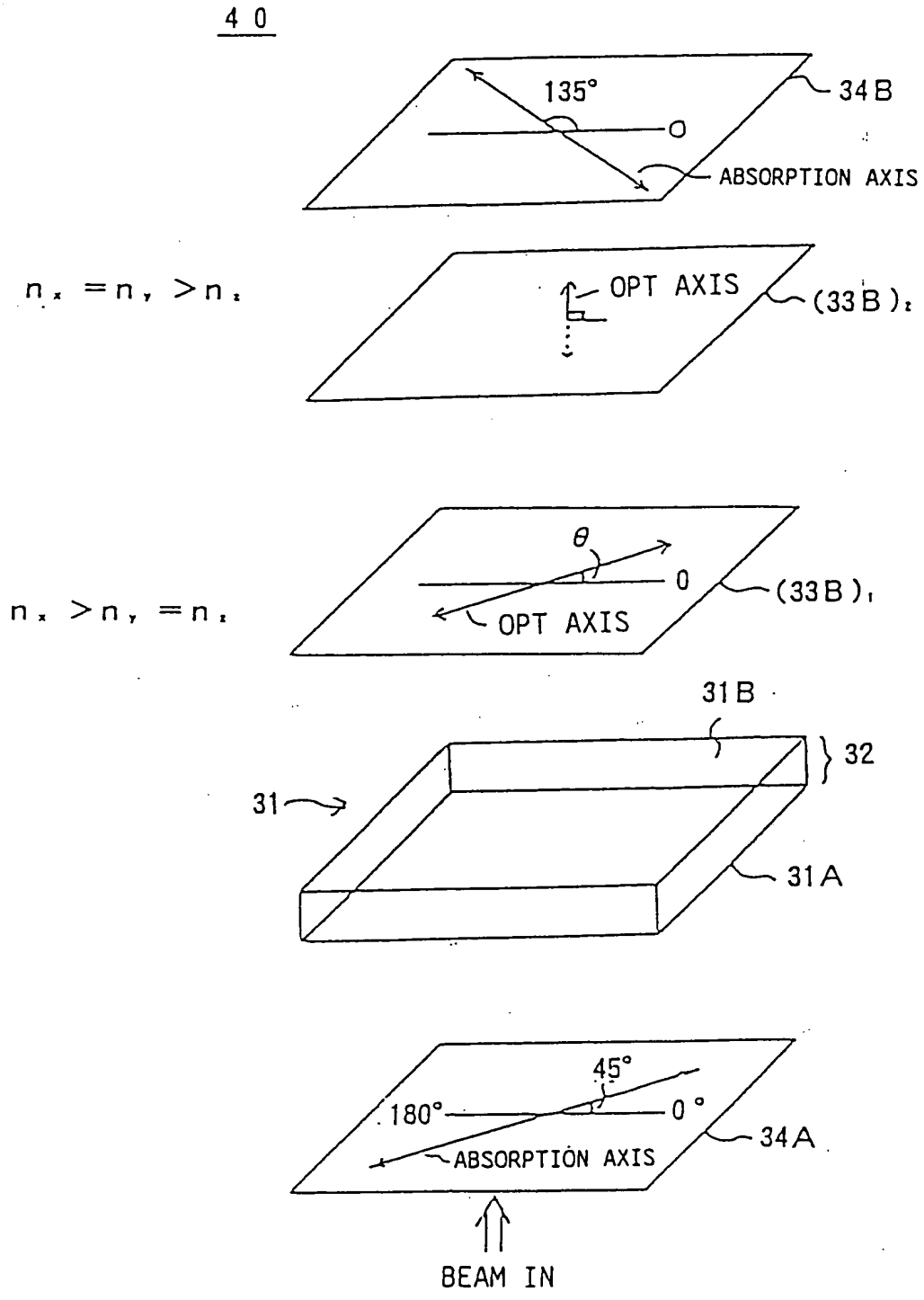

40
135°
34B
O
ABSORPTION AXIS
$n_x = n_y > n_z$
OPT AXIS
(33B)z
$n_x > n_y = n_z$
θ
0
(33B)1
OPT AXIS
31B
32
31
31A
45°
180°
0°
34A
ABSORPTION AXIS
BEAM IN

FIG. 55

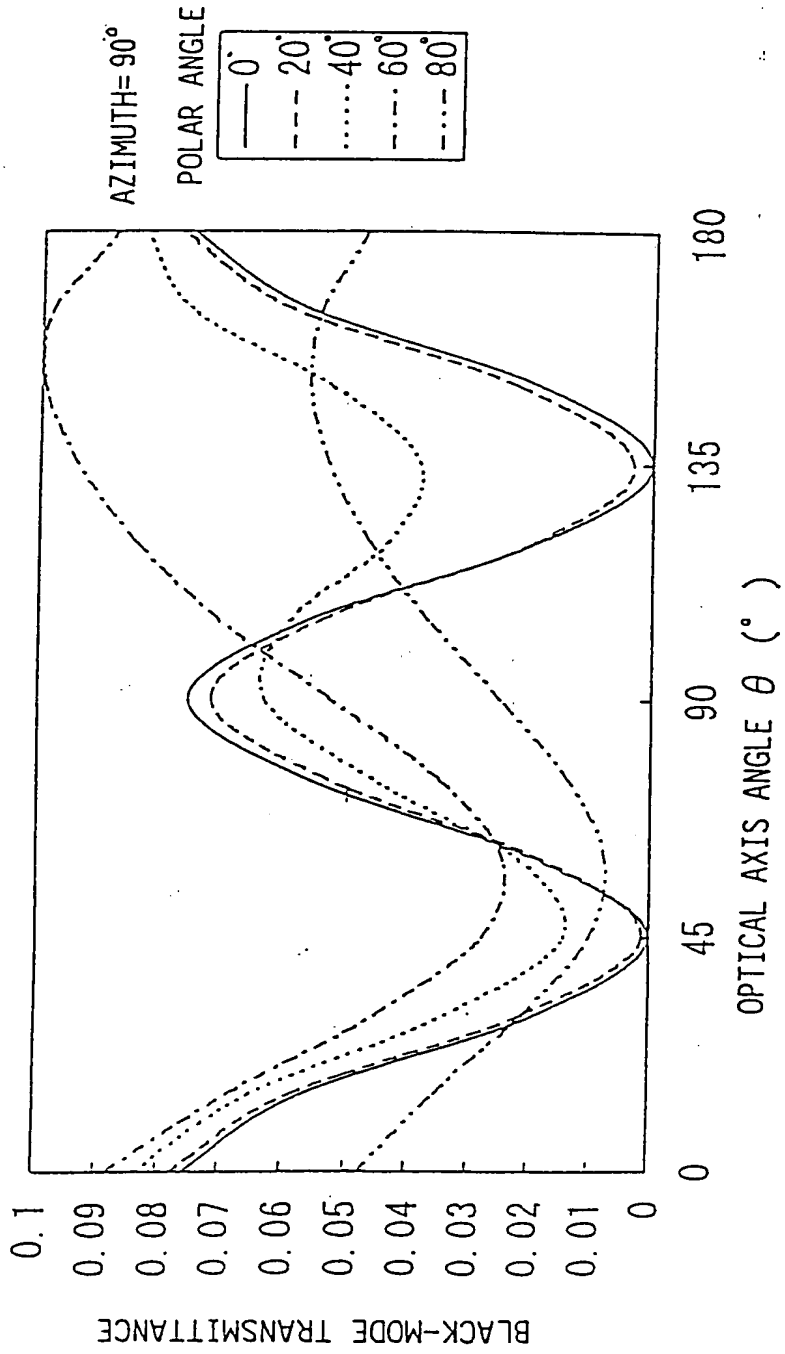

AZIMUTH= 90°
POLAR ANGLE
0°
20°
40°
60°
80°
BLACK-MODE TRANSMITTANCE
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
45
90
135
180
OPTICAL AXIS ANGLE θ (°)

FIG. 56

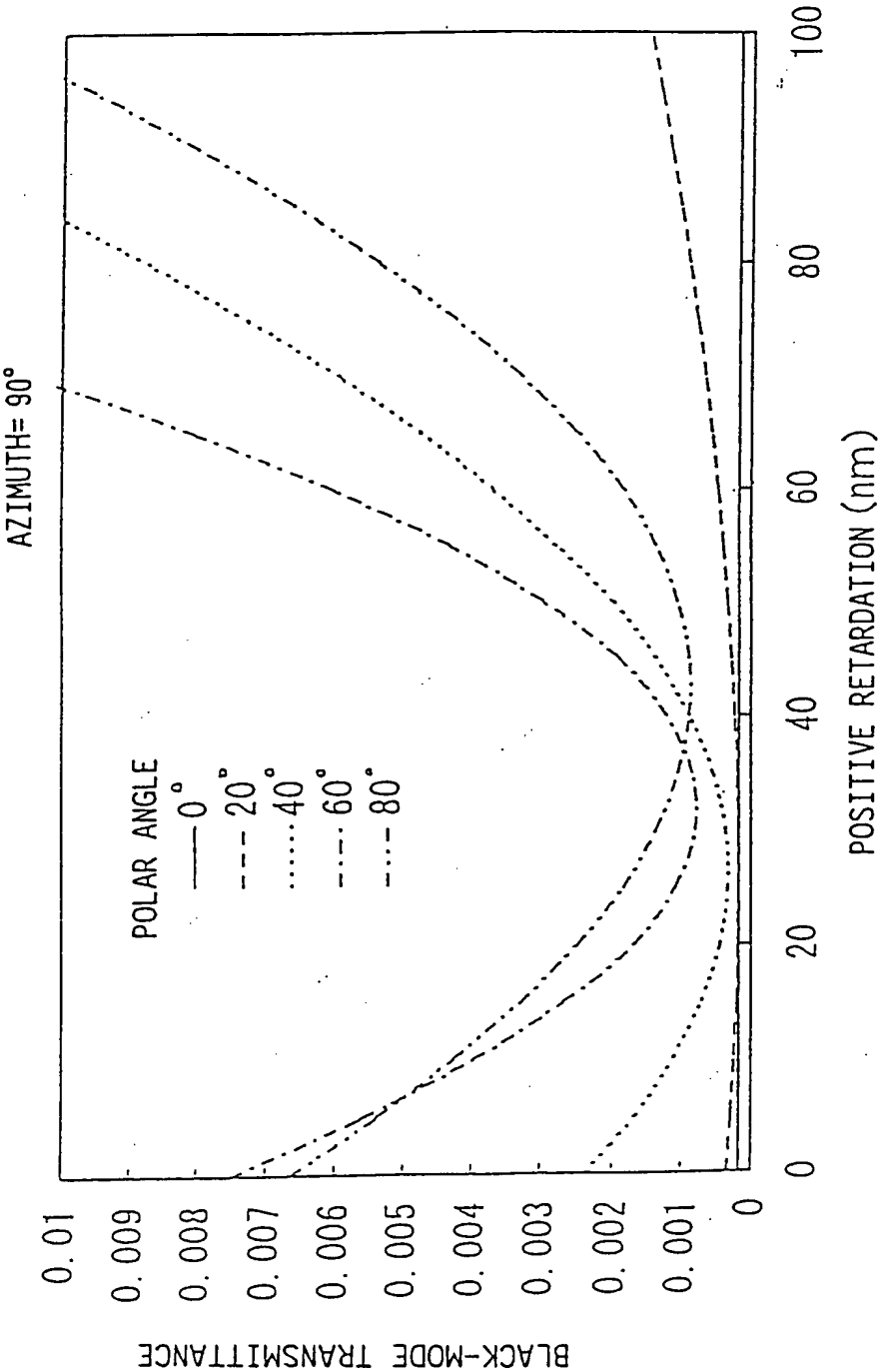

AZIMUTH= 90°
POLAR ANGLE
0°
20°
40°
60°
80°
BLACK-MODE TRANSMITTANCE
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
20
40
60
80
100
POSITIVE RETARDATION (nm)

FIG.57

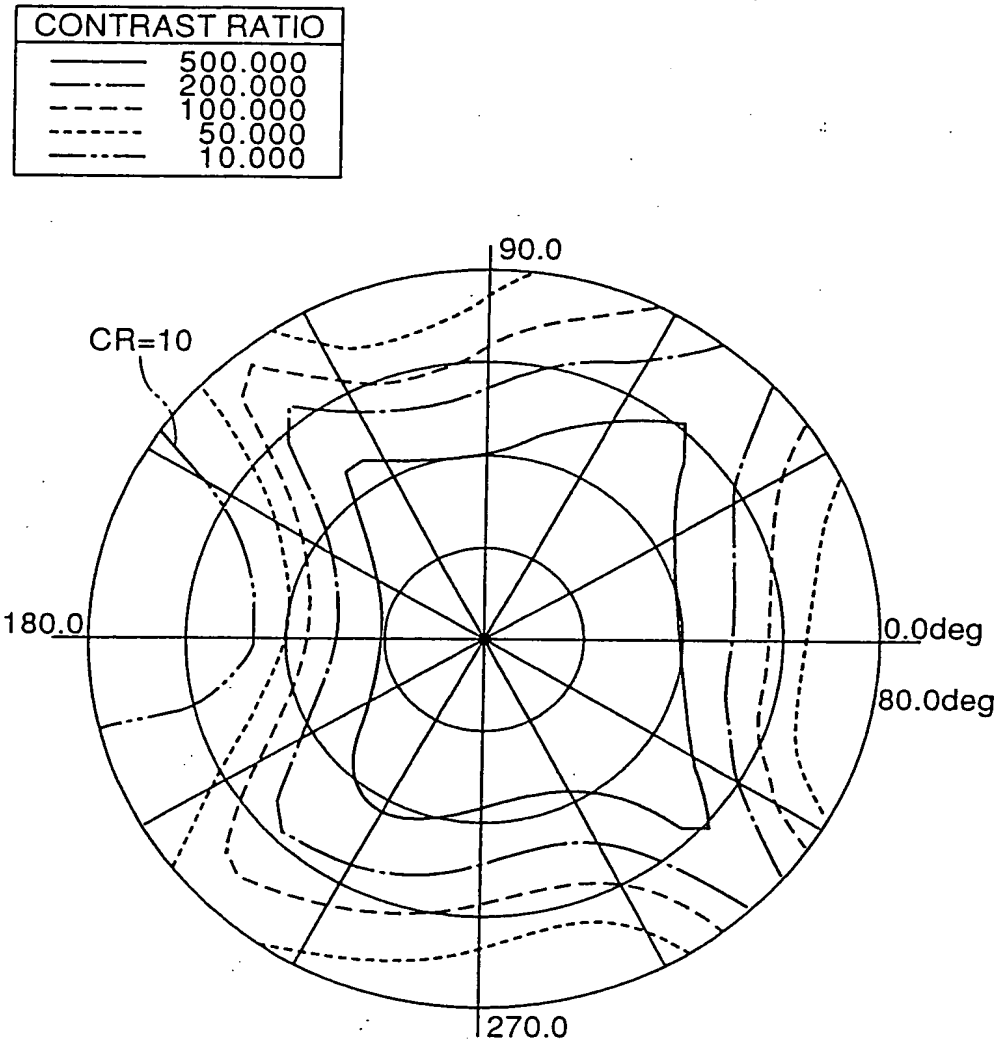

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
90.0
CR=10
180.0
0.0deg
80.0deg
270.0
45° TWIST
d = 3 μm
R'= 240nm
R = 25nm

FIG.58

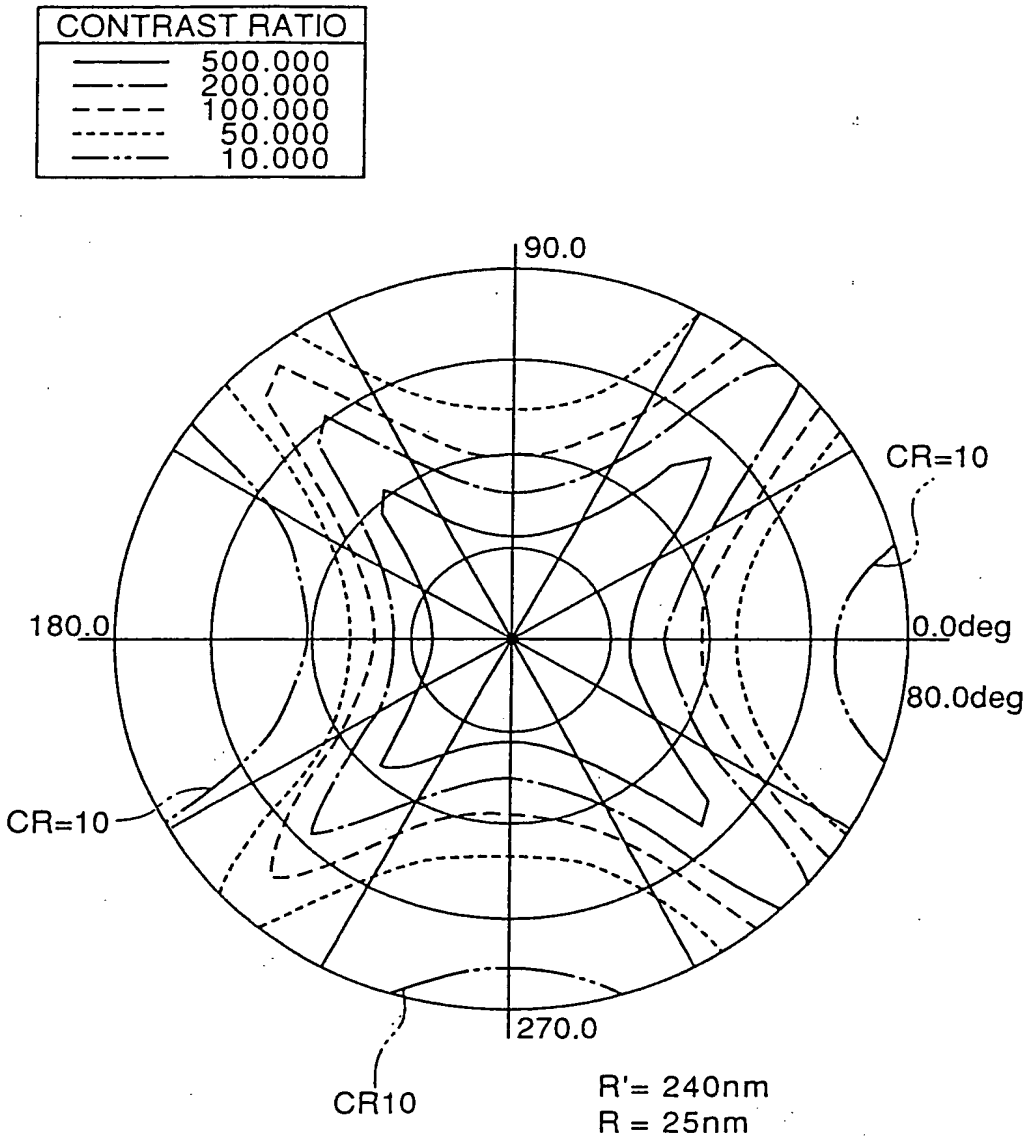

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
80.0deg
270.0
CR=10
CR=10
CR10
R'= 240nm
R = 25nm

FIG.59

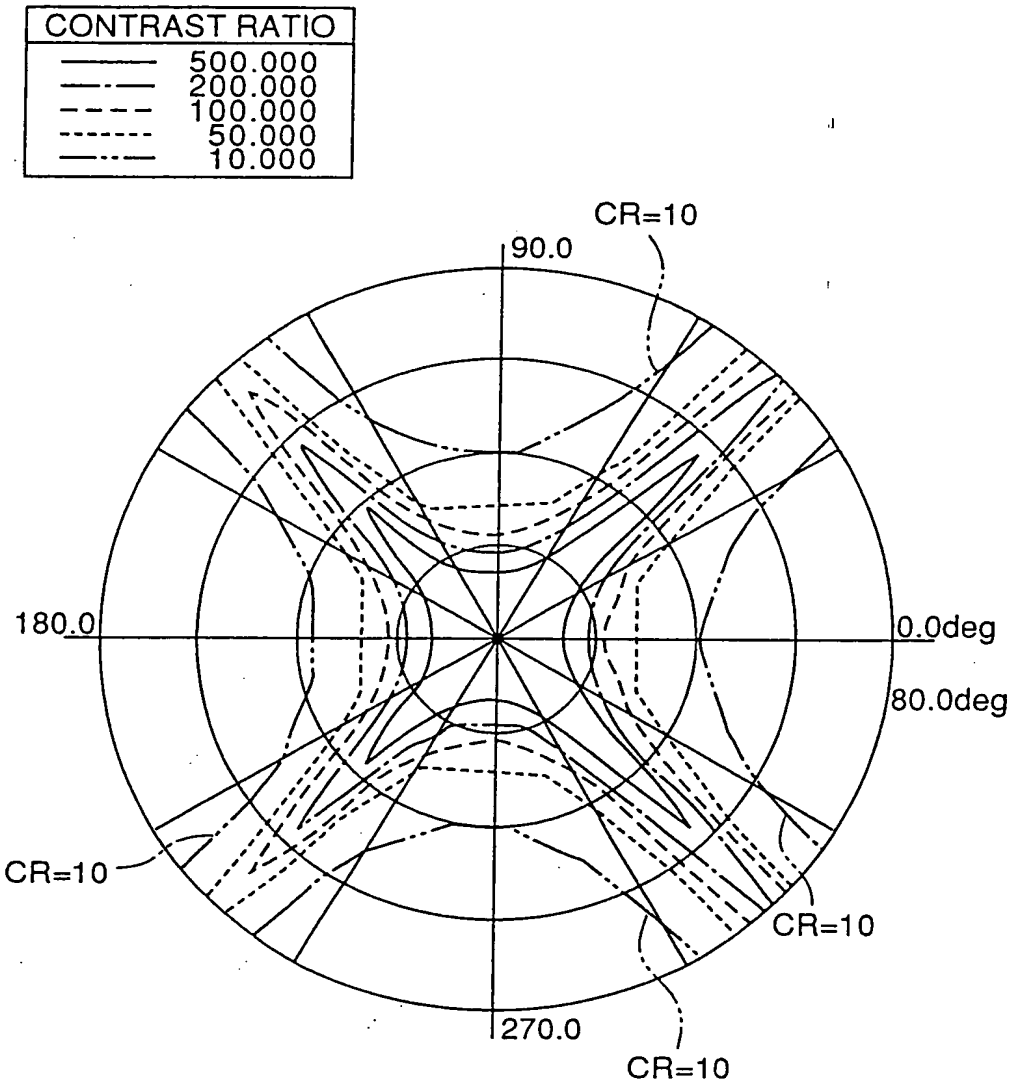

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
CR=10
90.0
180.0
0.0deg
80.0deg
CR=10
CR=10
270.0
CR=10

FIG.60

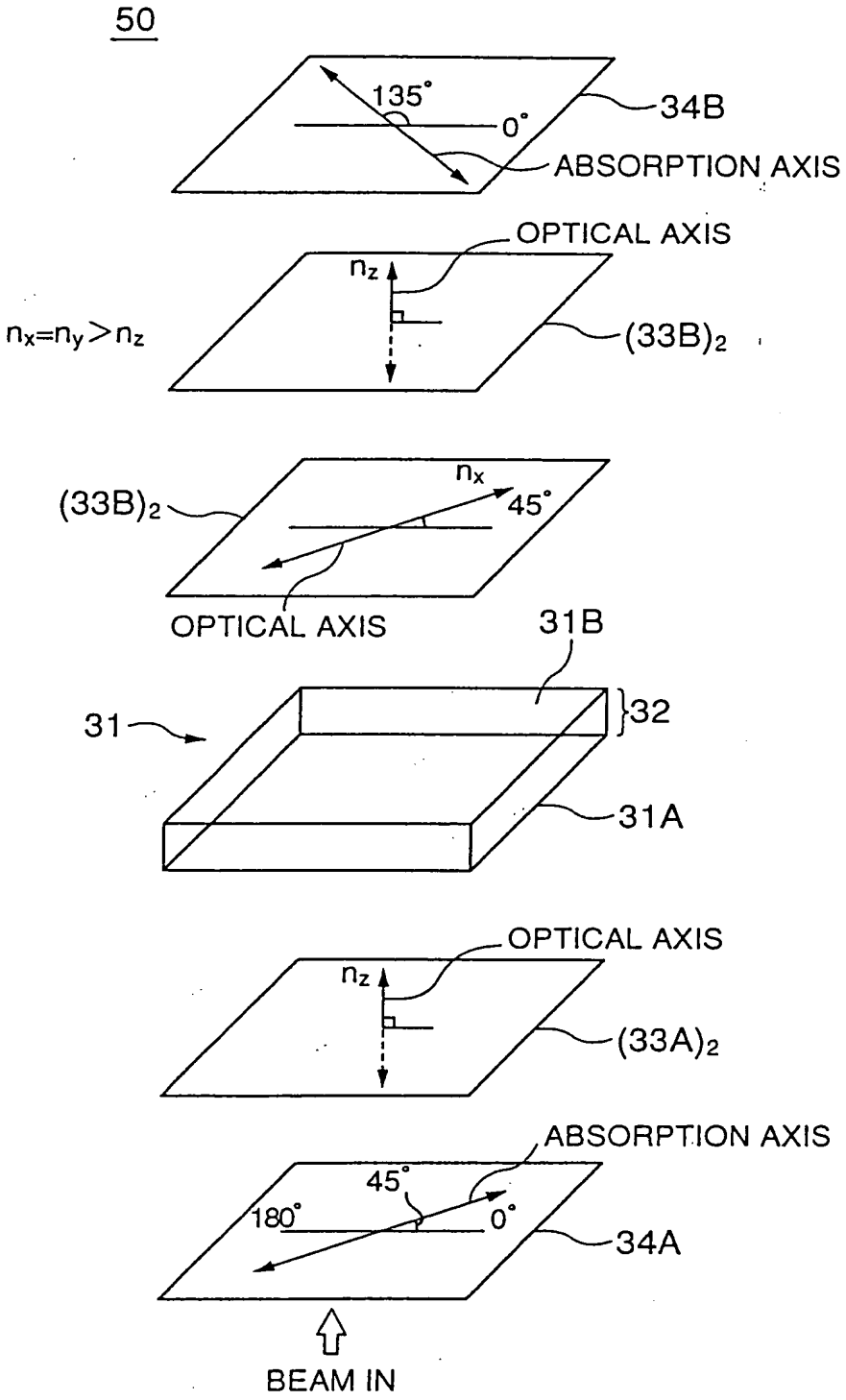
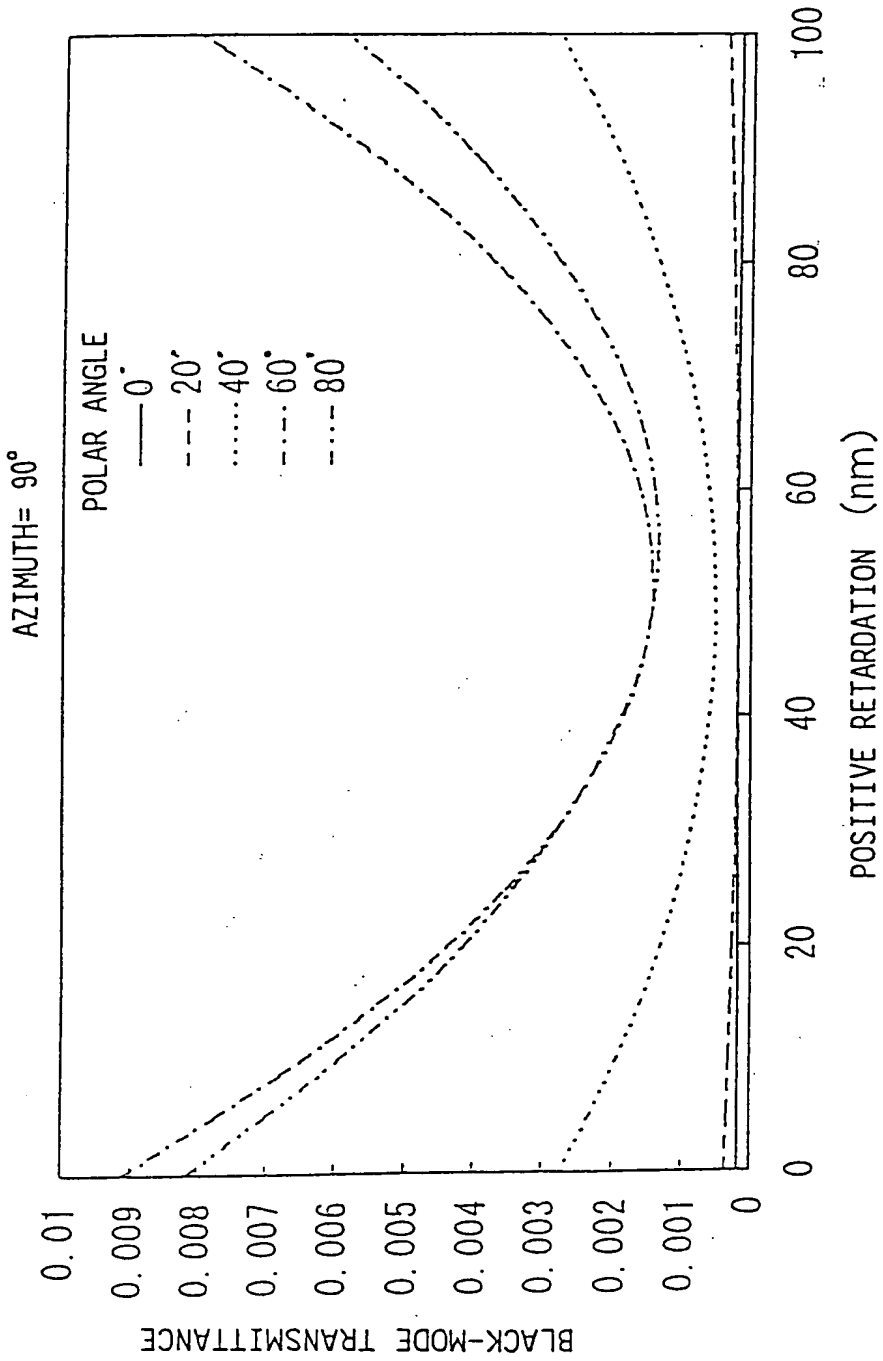

50
135°
0°
34B
ABSORPTION AXIS
OPTICAL AXIS
n_z
$n_x=n_y>n_z$
$(33B)_2$
n_x
45°
$(33B)_2$
OPTICAL AXIS
31B
31
32
31A
OPTICAL AXIS
n_z
$(33A)_2$
ABSORPTION AXIS
45°
180°
0°
34A
BEAM IN

FIG. 61


AZIMUTH= 90°
POLAR ANGLE
0°
20°
40°
60°
80°
BLACK-MODE TRANSMITTANCE
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
20
40
60
80
100
POSITIVE RETARDATION (nm)

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Filed: September 22, 2003
(James K. Folker)
(312) 360-0080

FIG. 62

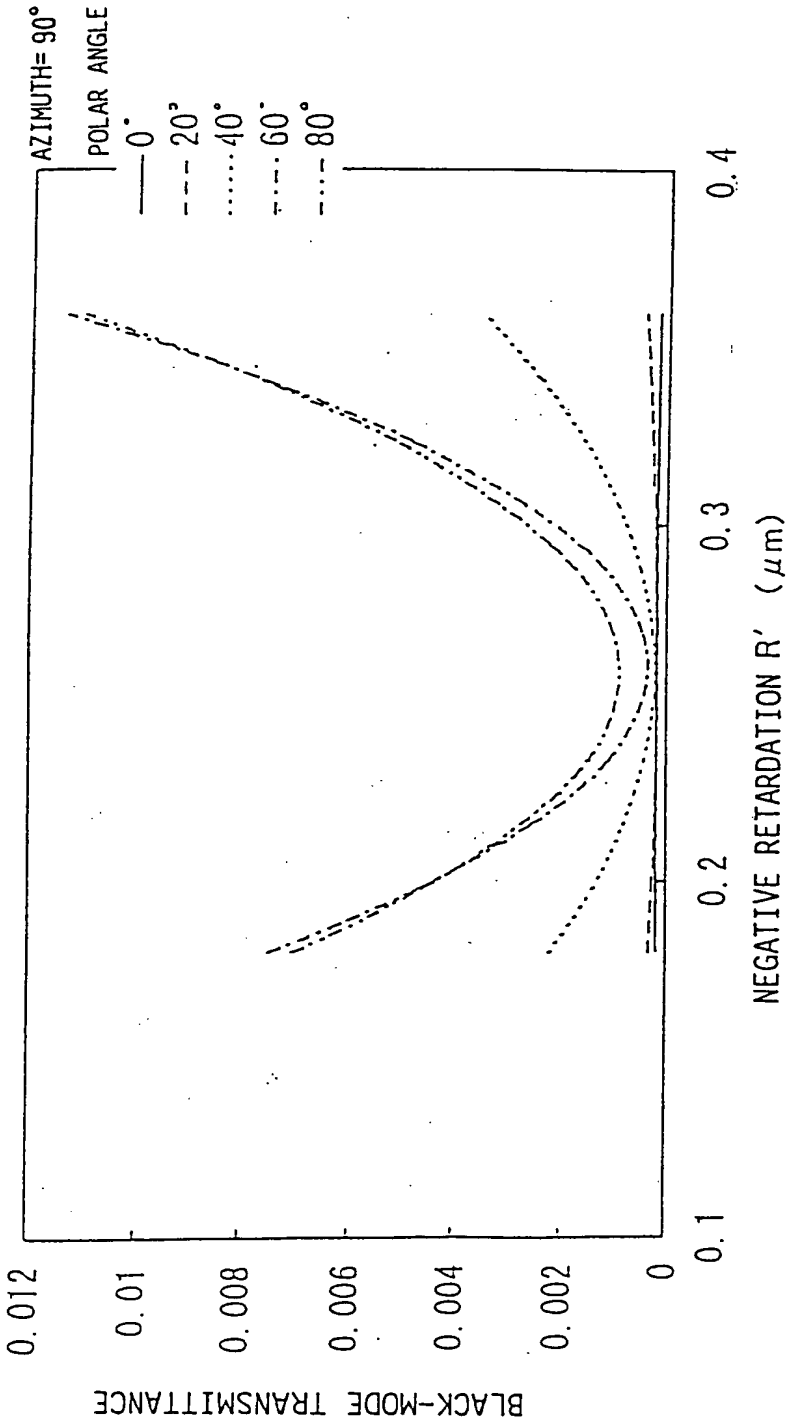


FIG. 63

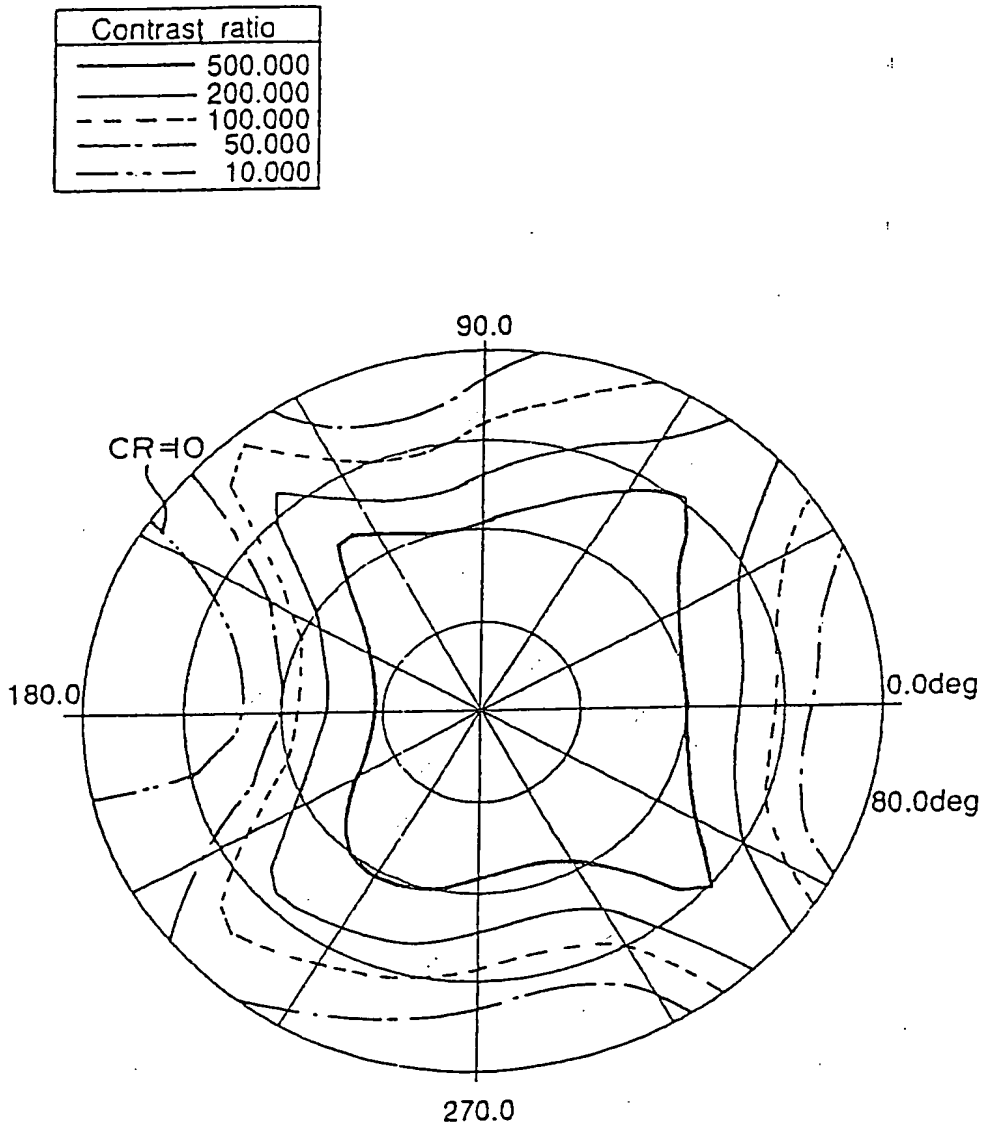

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
CR=10
180.0
0.0deg
80.0deg
270.0

FIG. 64

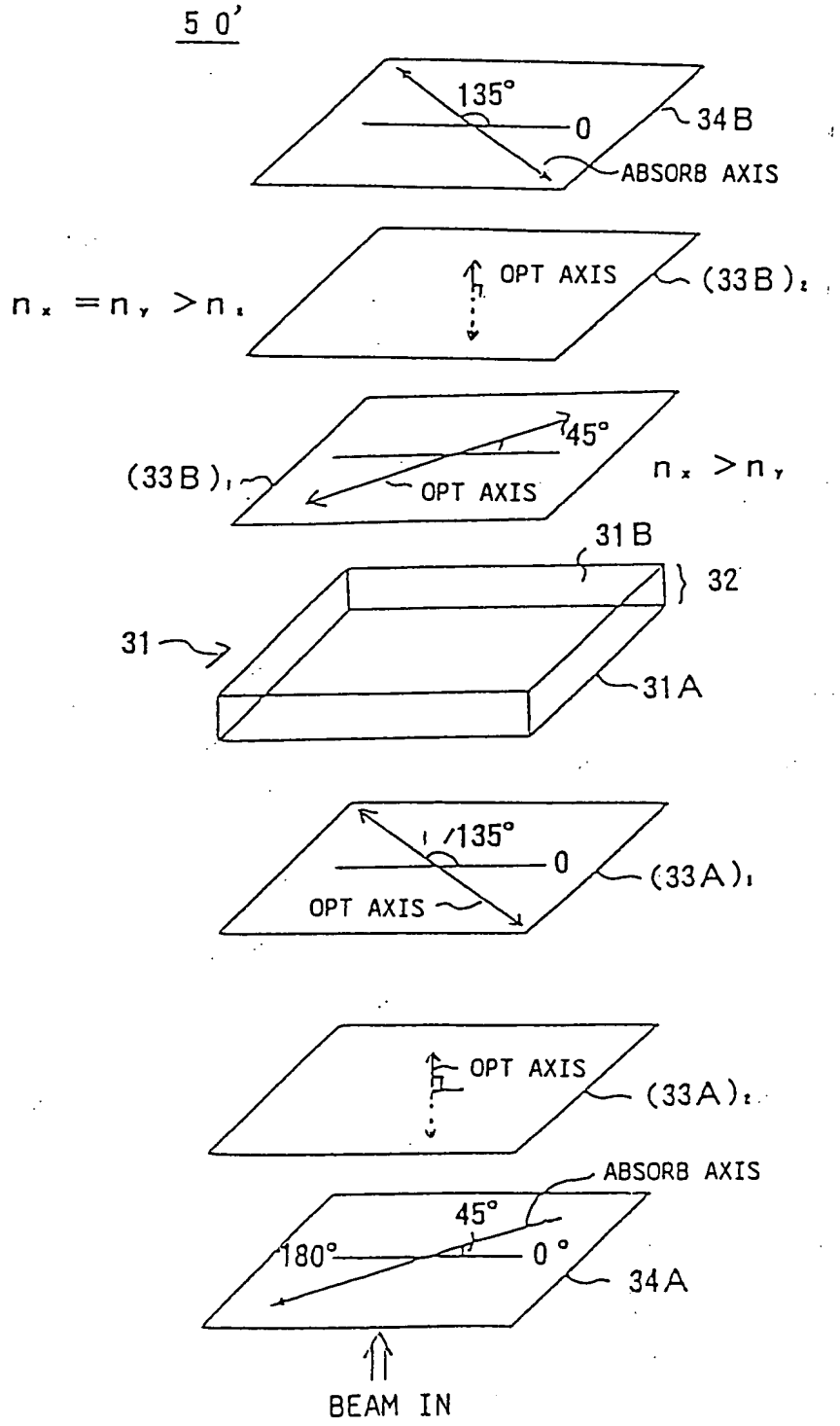

50'
135°
0
34B
ABSORB AXIS
$n_x = n_y > n_z$
OPT AXIS
(33B)$_2$
45°
(33B)$_1$
OPT AXIS
$n_x > n_y$
31B
32
31
31A
135°
0
OPT AXIS
(33A)$_1$
OPT AXIS
(33A)$_2$
ABSORB AXIS
45°
180°
0°
34A
BEAM IN

FIG. 65

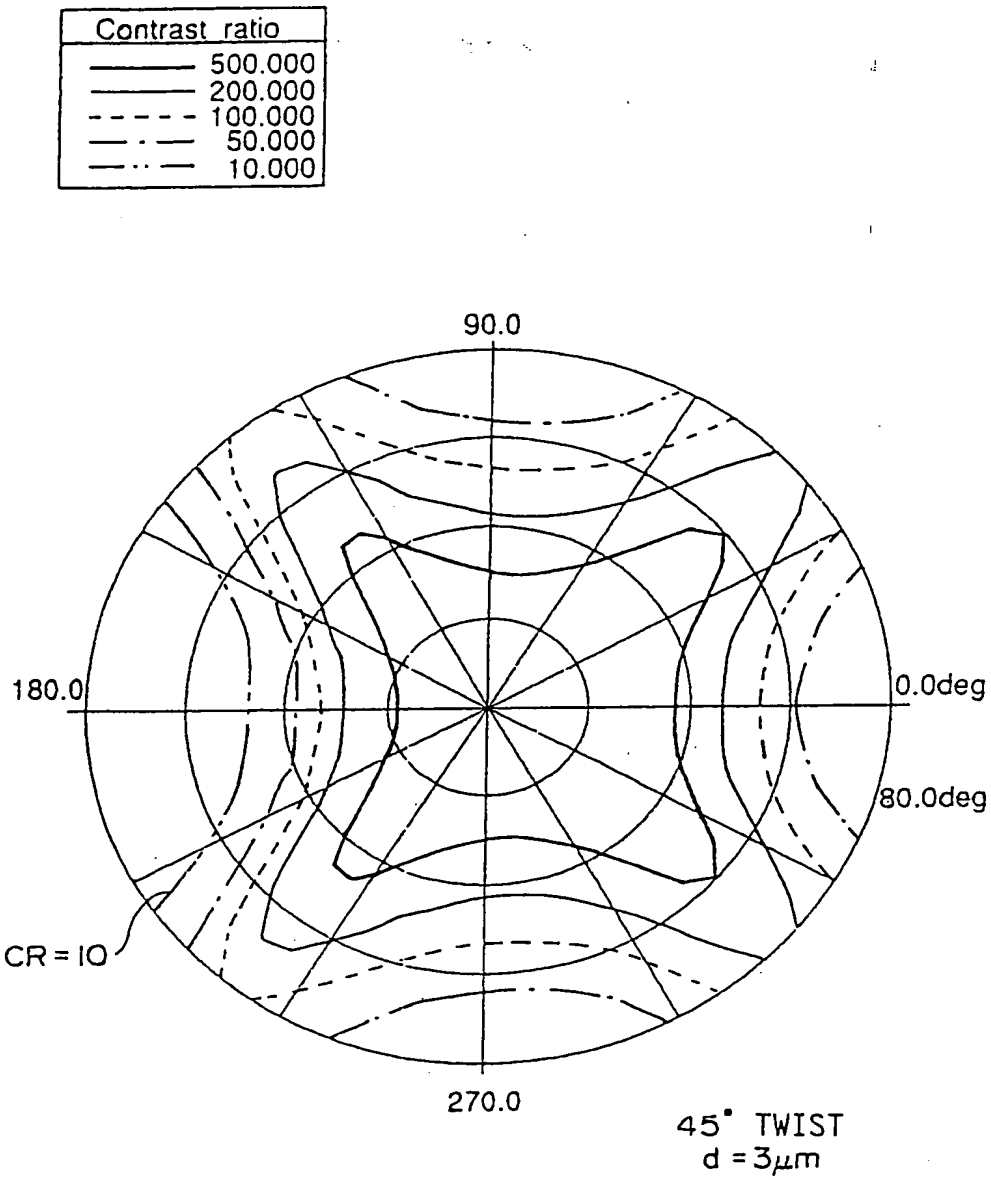

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
80.0deg
270.0
CR = 10
45° TWIST
d = 3μm

FIG. 66

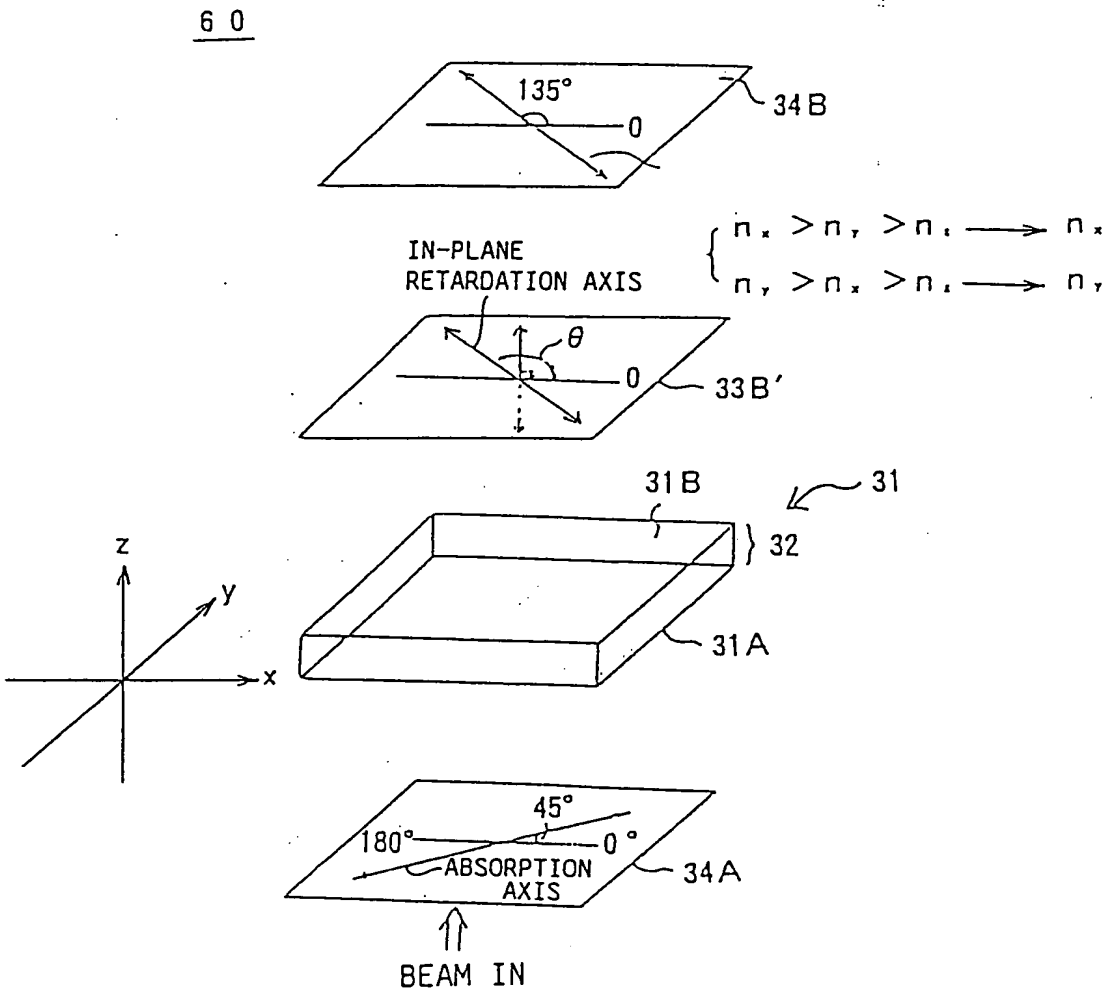

60
135°
0
34B
IN-PLANE
RETARDATION AXIS
$n_x > n_y > n_z \longrightarrow n_x$
$n_y > n_x > n_z \longrightarrow n_y$
θ
0
33B'
31B
31
32
z
y
x
31A
45°
180°
0°
ABSORPTION
AXIS
34A
BEAM IN

FIG.67

	VOLT	POLAR	AZIMUTH
———	0.000	0.0	90.0
—·—·—	0.000	20.0	90.0
– – – –	0.000	40.0	90.0
----------	0.000	60.0	90.0
—··—··—	0.000	80.0	90.0

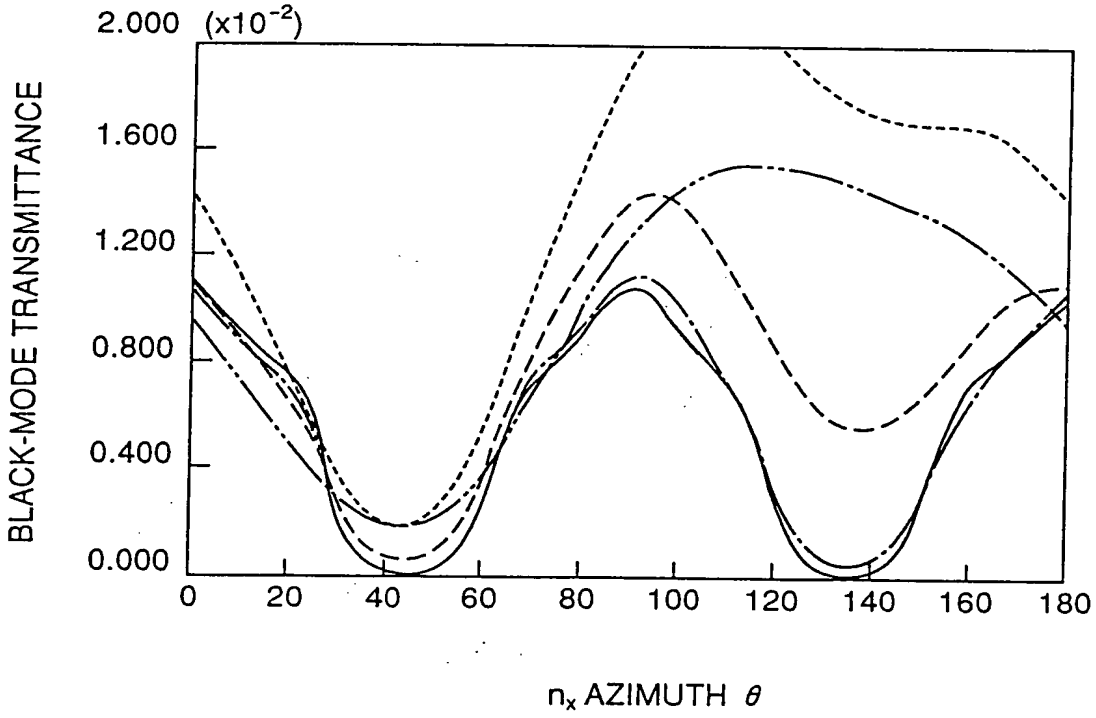


FIG.68

	VOLT	POLAR	AZIMUTH
———	0.000	0.0	0.0
—·—·—	0.000	20.0	0.0
- - - - -	0.000	40.0	0.0
----------	0.000	60.0	0.0
—··—··—	0.000	80.0	0.0

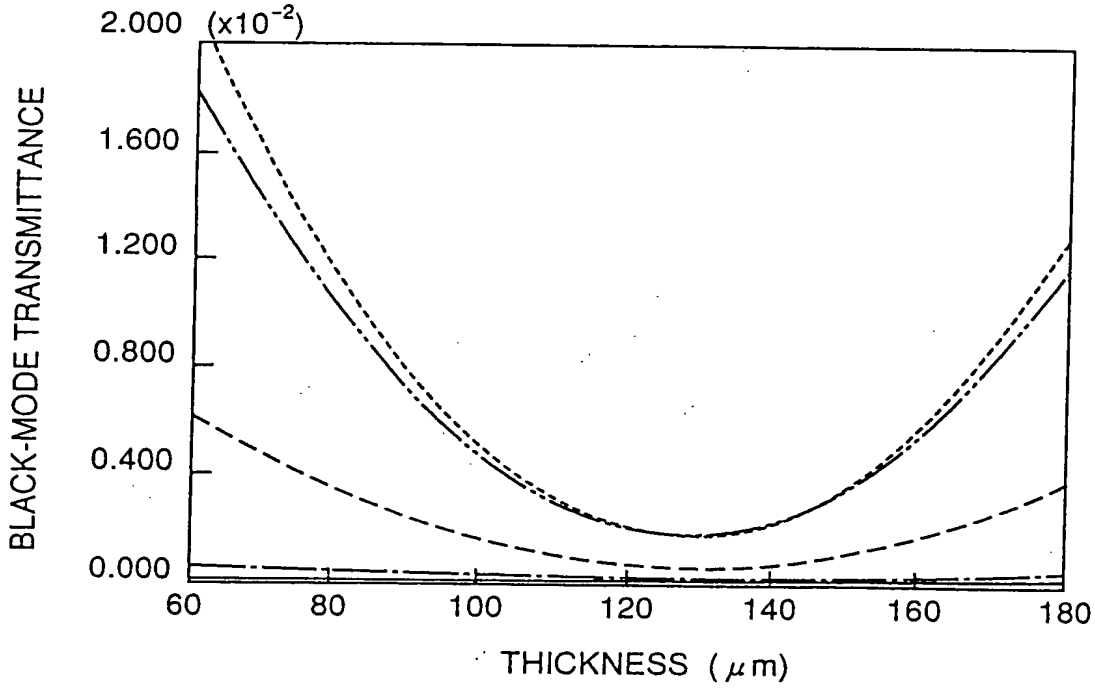


FIG.69

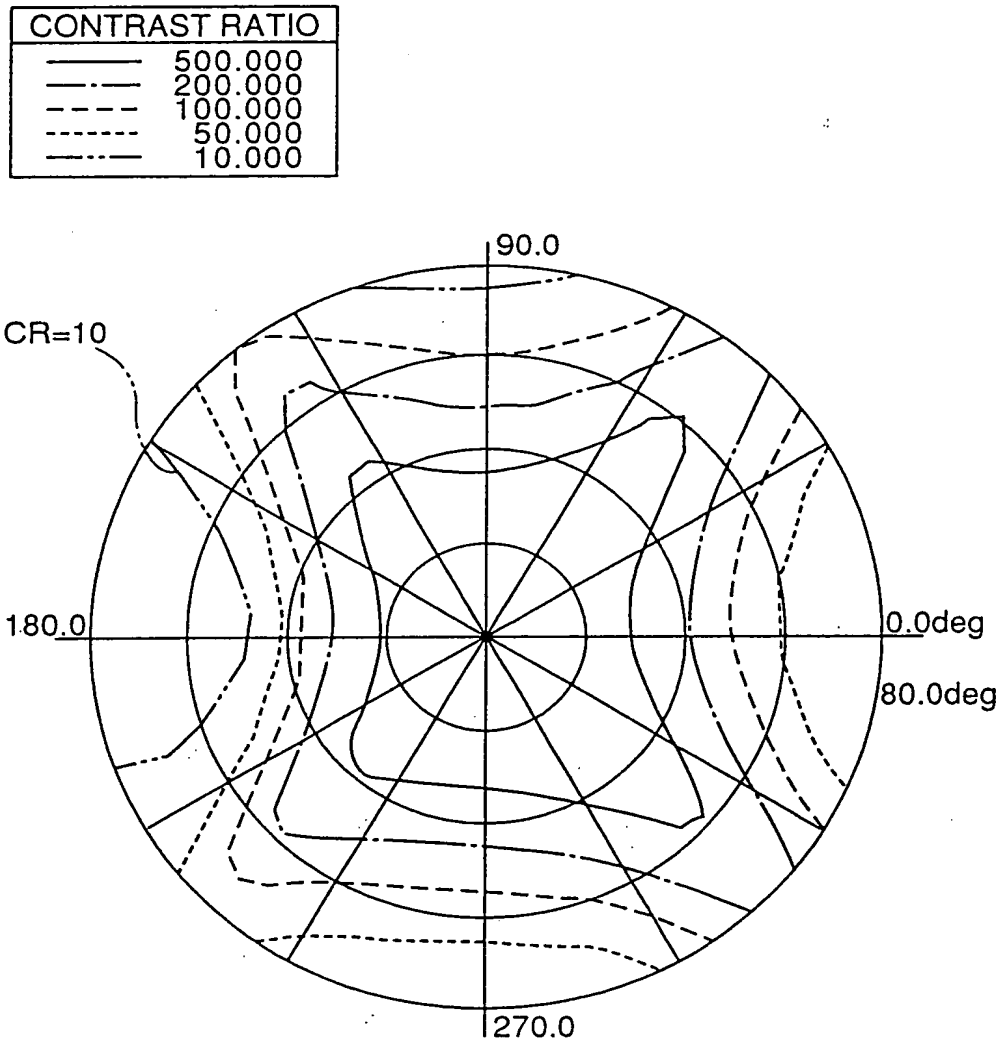

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
90.0
CR=10
180.0
0.0deg
80.0deg
270.0

FIG.70

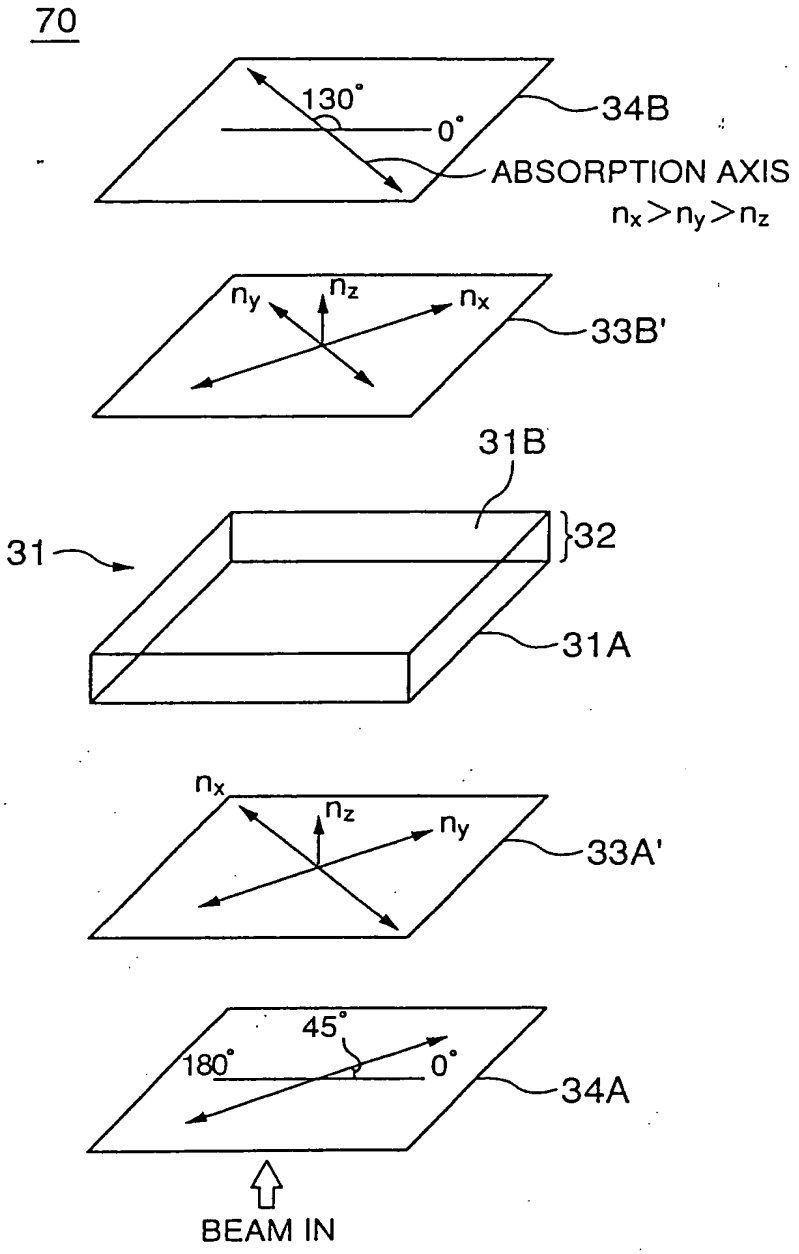

70
130°
0°
34B
ABSORPTION AXIS
$n_x > n_y > n_z$
n_y
n_z
n_x
33B'
31B
31
32
31A
n_x
n_z
n_y
33A'
45°
180°
0°
34A
BEAM IN

FIG.71

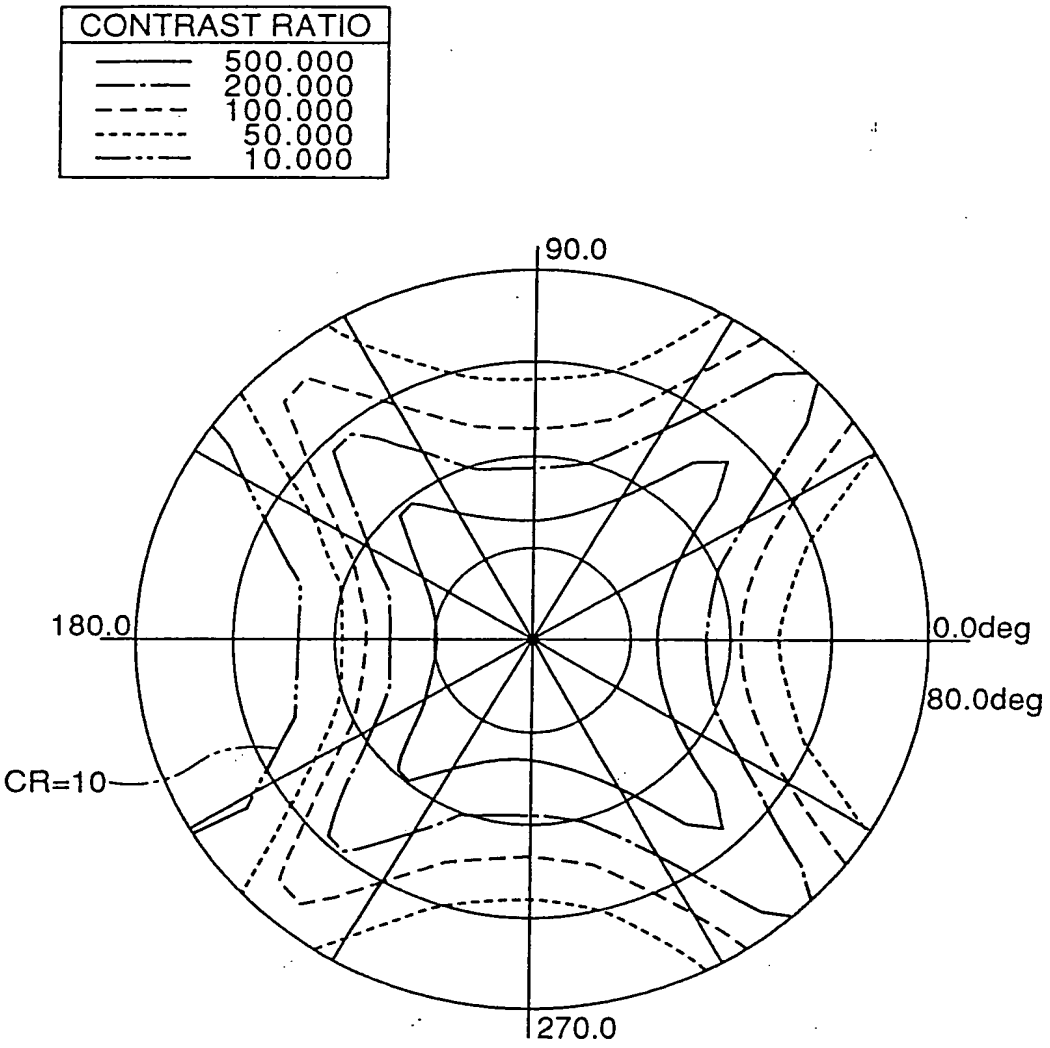

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
80.0deg
CR=10
270.0

FIG.72

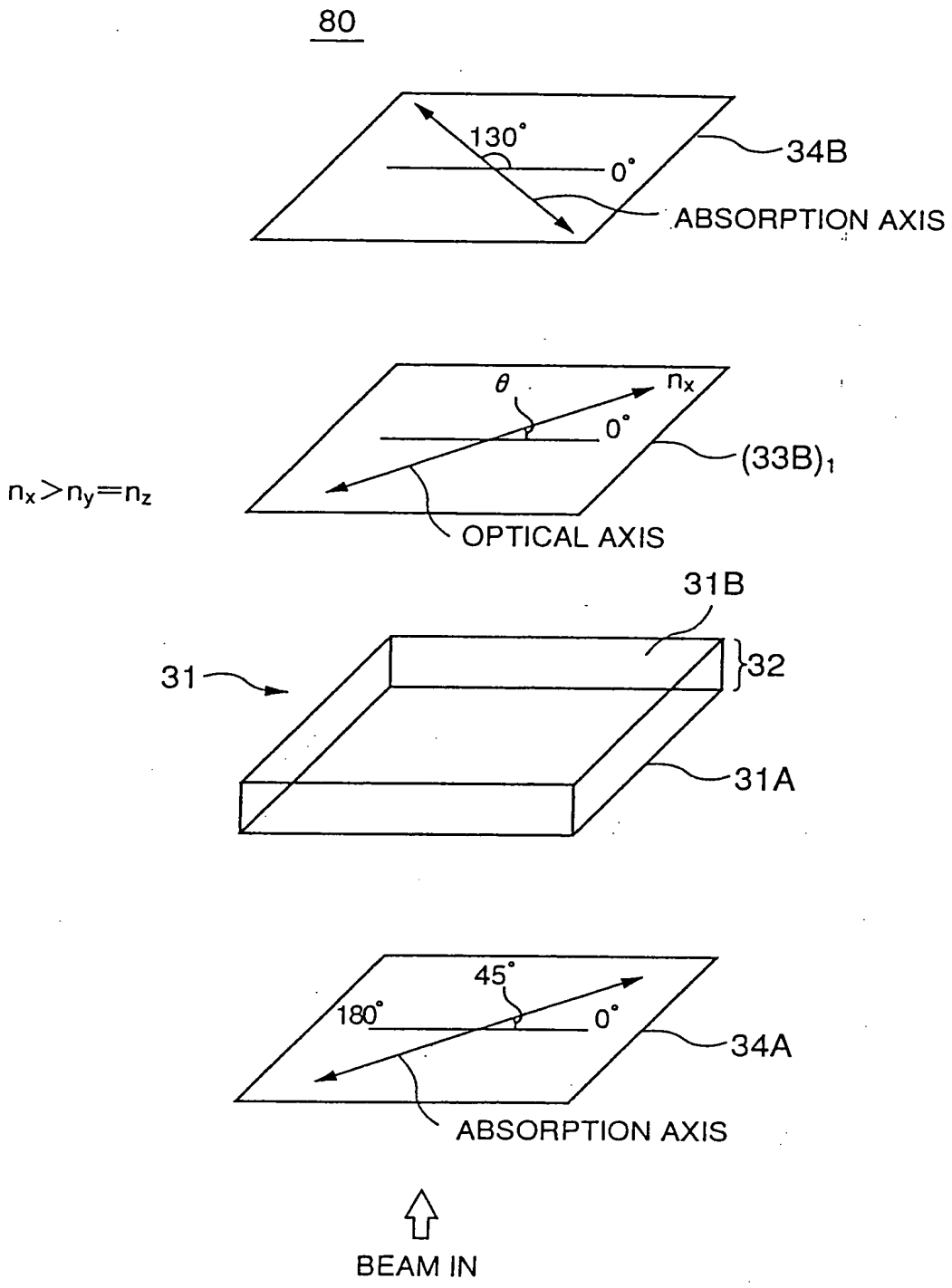

80
130°
0°
34B
ABSORPTION AXIS
θ
nx
0°
(33B)1
nx>ny=nz
OPTICAL AXIS
31B
31
32
31A
45°
180°
0°
34A
ABSORPTION AXIS
BEAM IN

FIG.73

	VOLT	POLAR	AZIMUTH
———	0.000	0.0	0.0
——·——	0.000	20.0	0.0
– – – –	0.000	40.0	0.0
----------	0.000	60.0	0.0
—·—·—	0.000	80.0	0.0

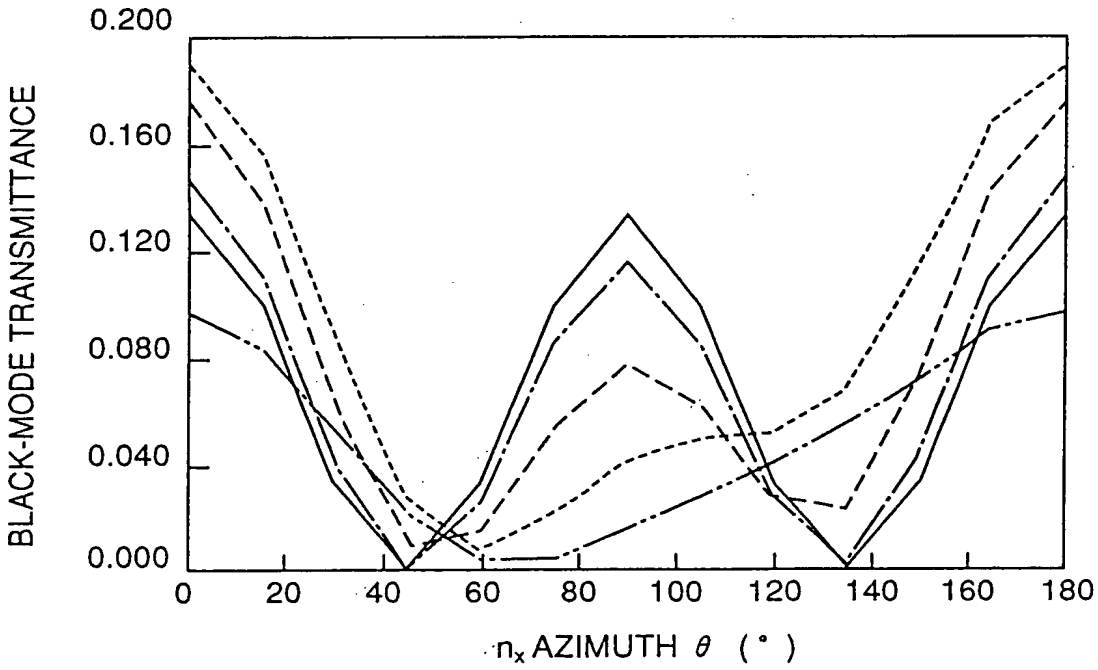


FIG.74

	VOLT	POLAR	AZIMUTH
———	0.000	0.0	0.0
—·—	0.000	20.0	0.0
- - -	0.000	40.0	0.0
·····	0.000	60.0	0.0
—··—	0.000	80.0	0.0

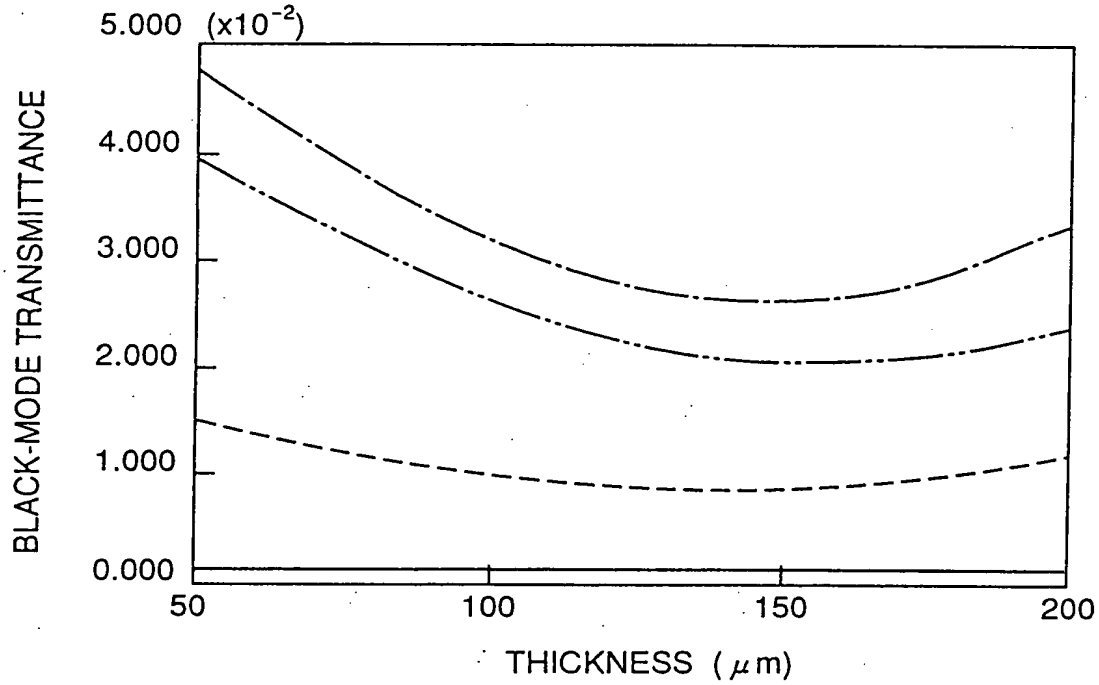


FIG.75

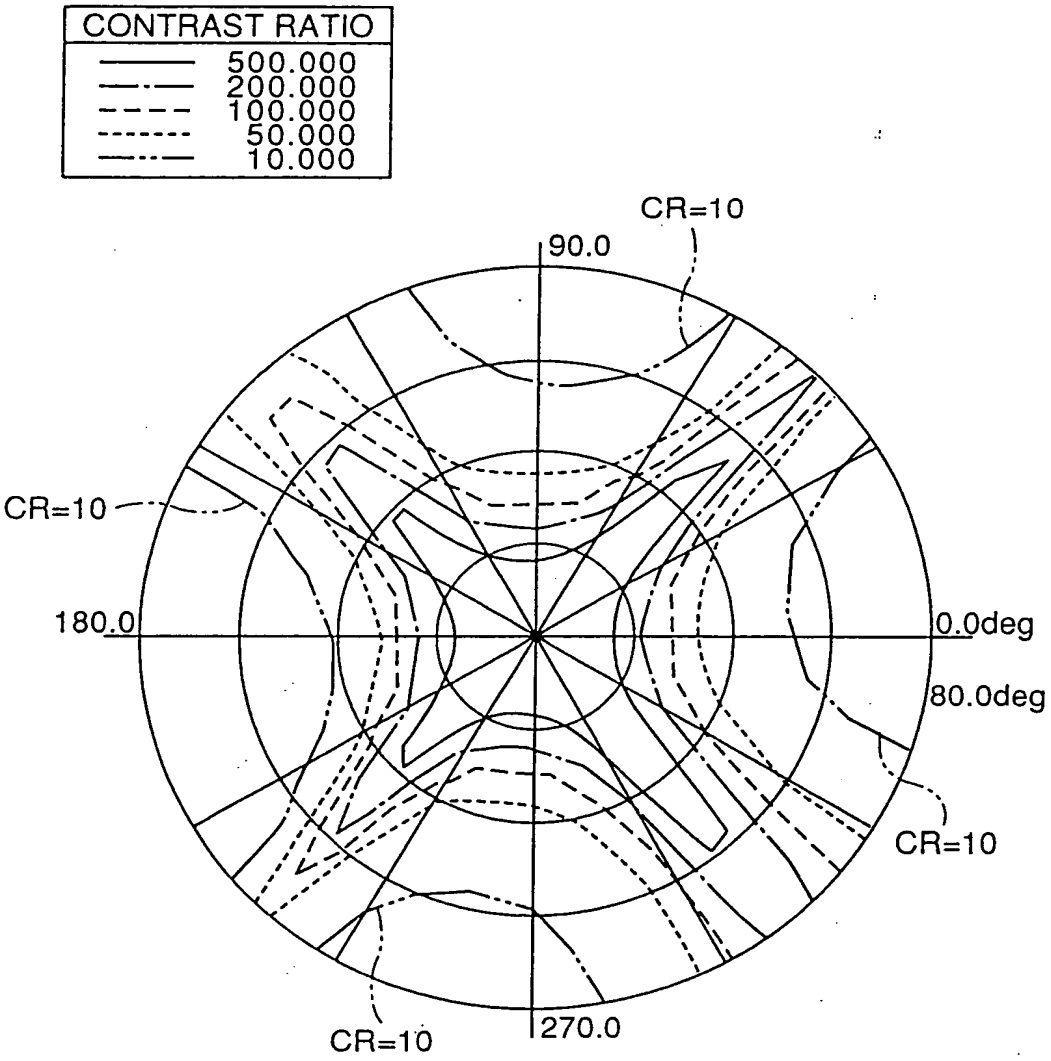

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
CR=10
90.0
CR=10
180.0
0.0deg
80.0deg
CR=10
CR=10
270.0

FIG.76

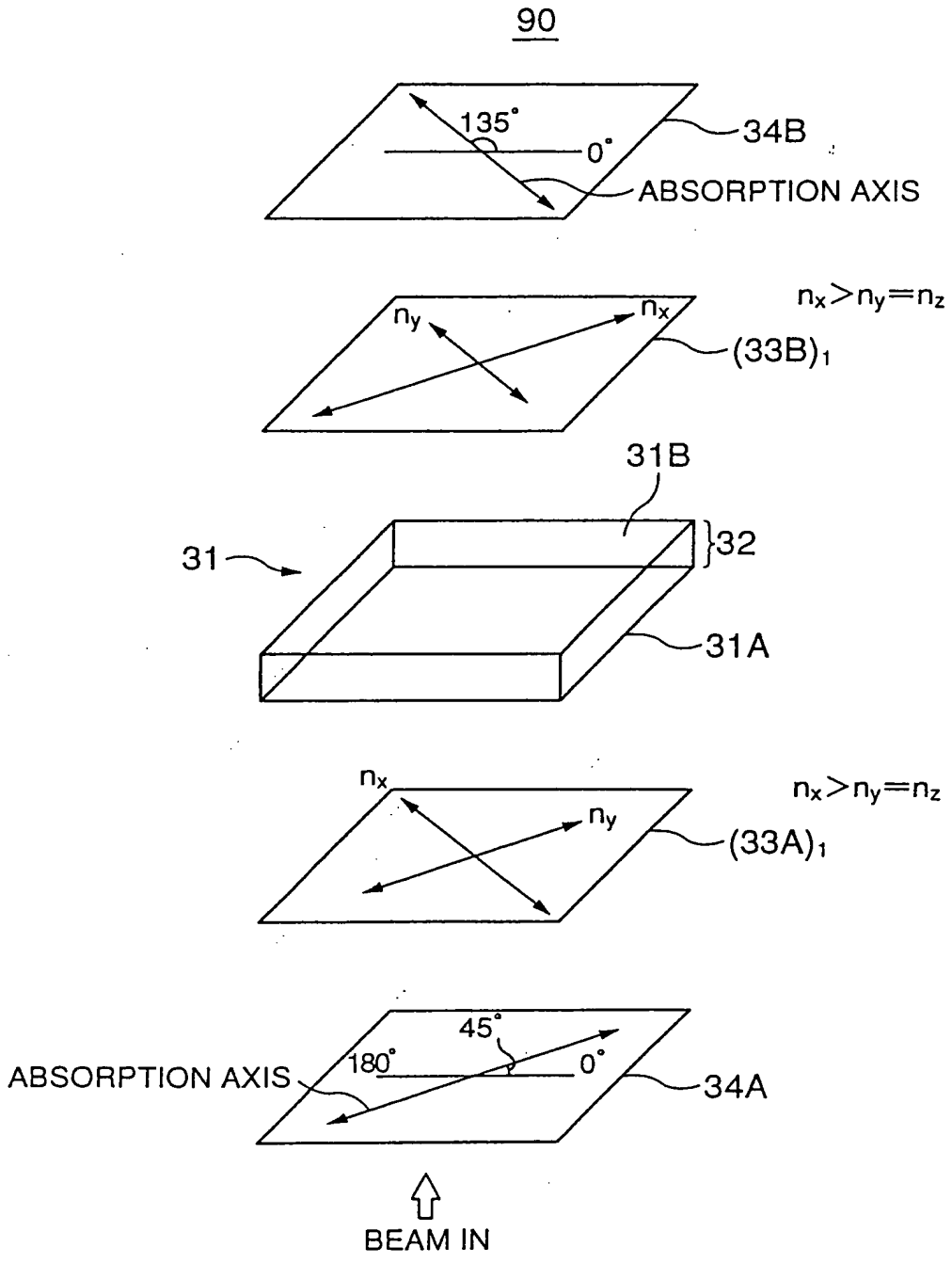

90
135°
0°
34B
ABSORPTION AXIS
$n_x > n_y = n_z$
n_y
n_x
$(33B)_1$
31B
31
32
31A
n_x
n_y
$n_x > n_y = n_z$
$(33A)_1$
45°
180°
0°
ABSORPTION AXIS
34A
BEAM IN

FIG.77

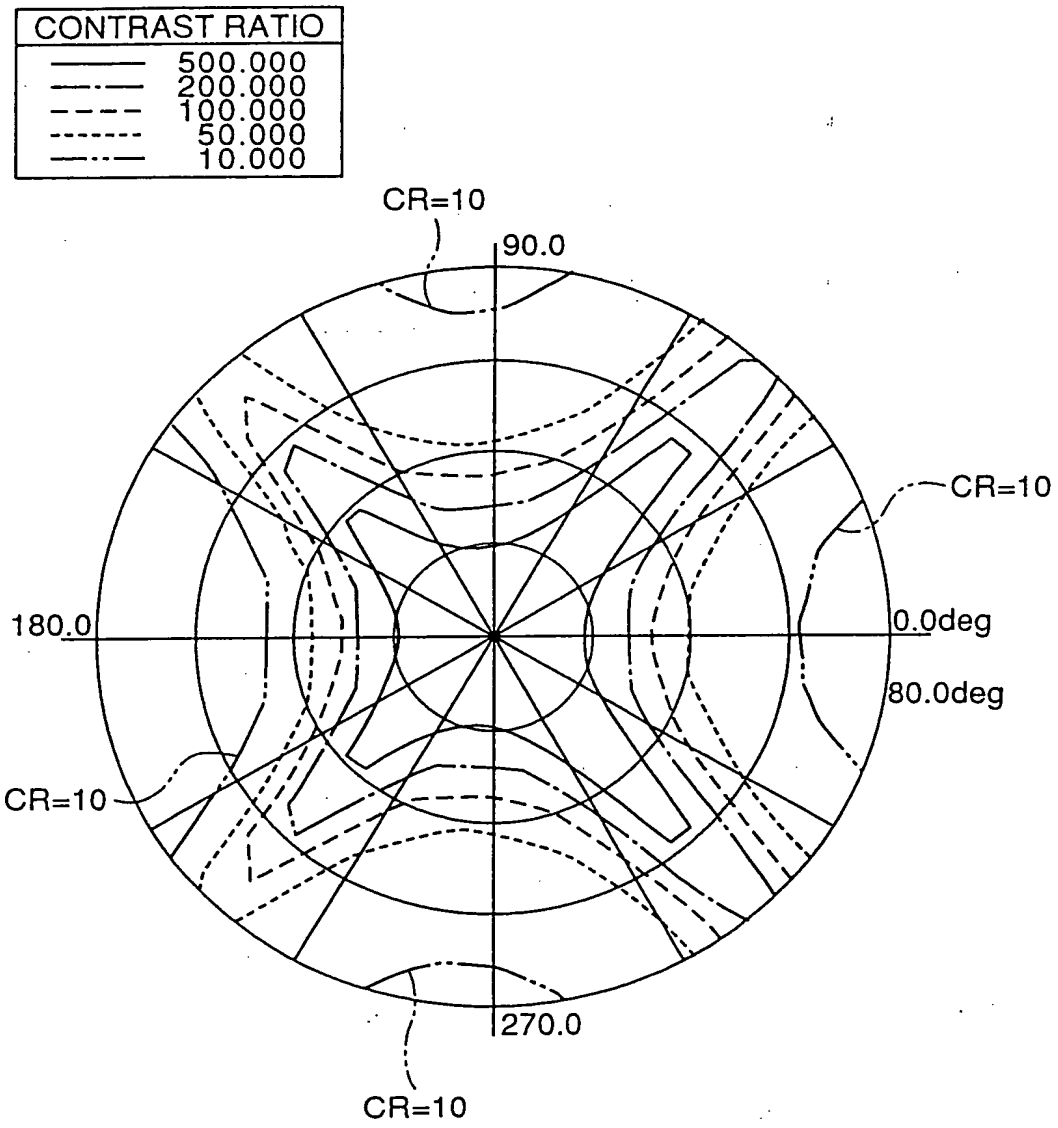

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
CR=10
90.0
CR=10
180.0
0.0deg
80.0deg
CR=10
270.0
CR=10

FIG.78

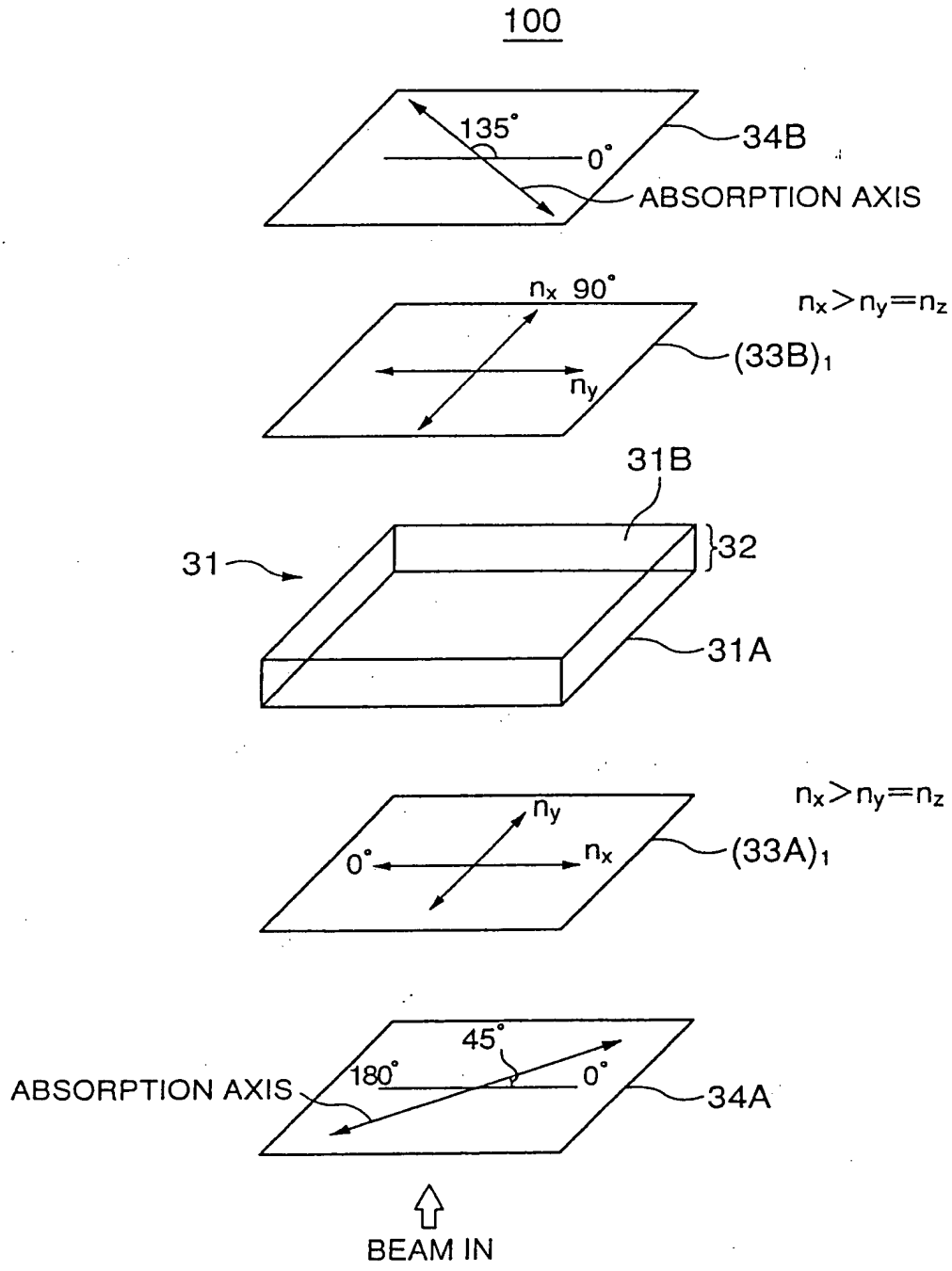

100
135°
0°
34B
ABSORPTION AXIS
n_x 90°
$n_x > n_y = n_z$
n_y
$(33B)_1$
31B
31
32
31A
$n_x > n_y = n_z$
n_y
0°
n_x
$(33A)_1$
45°
180°
0°
ABSORPTION AXIS
34A
BEAM IN

FIG.79

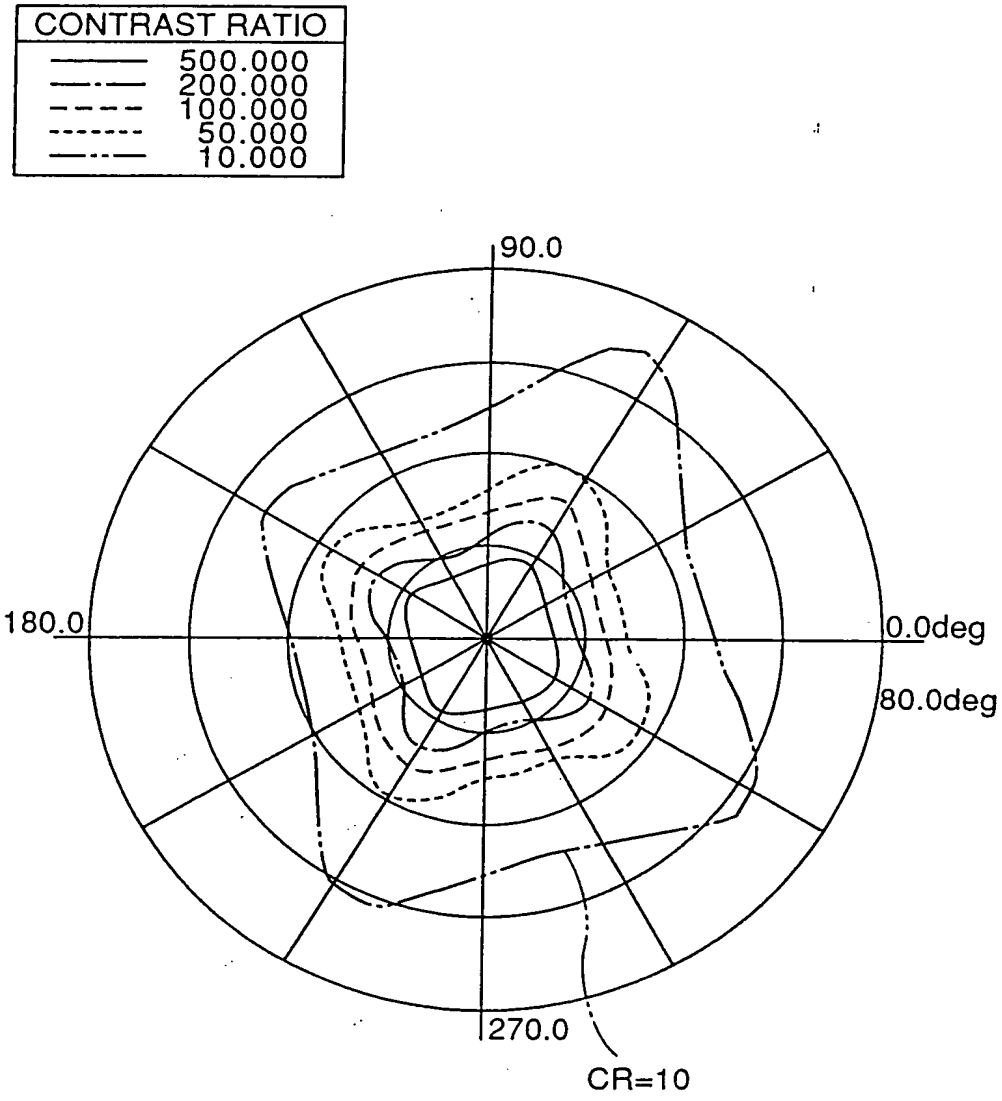

CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
80.0deg
270.0
CR=10

FIG. 80

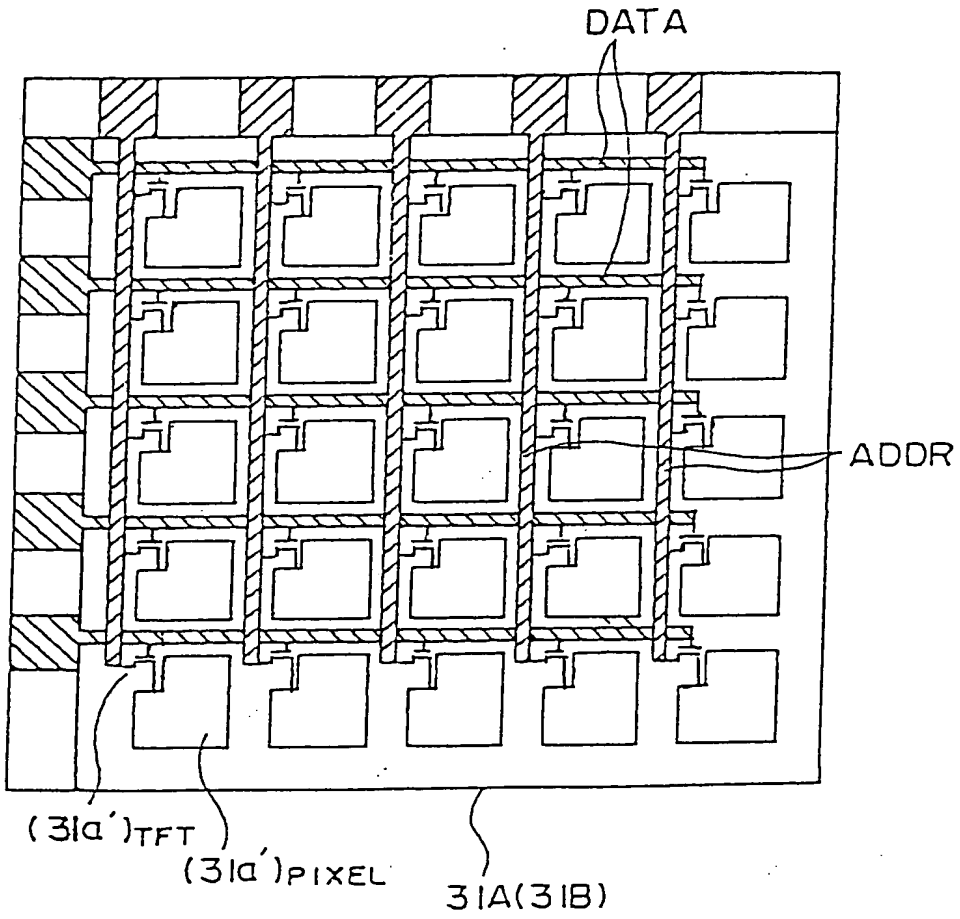


FIG. 81

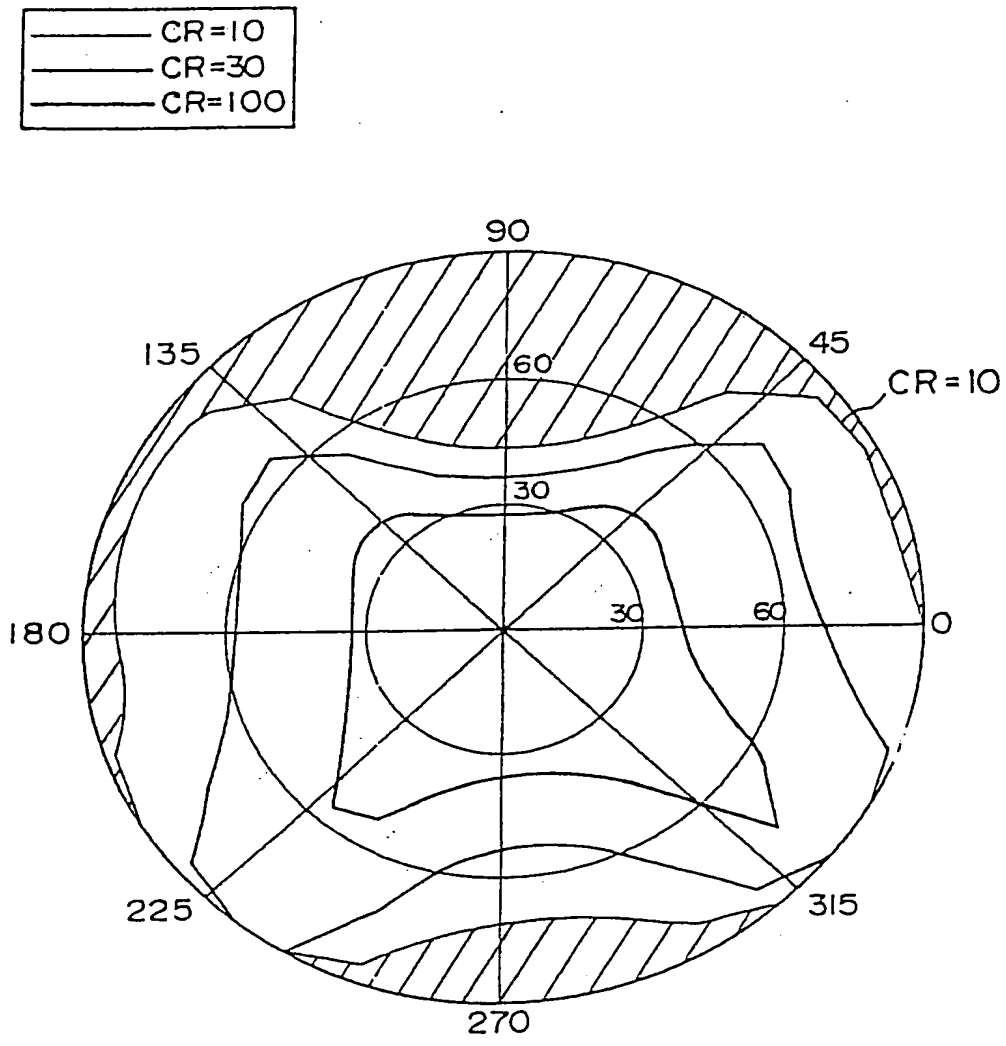


FIG. 82A

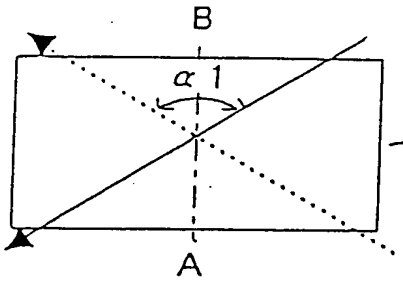


FIG. 82B

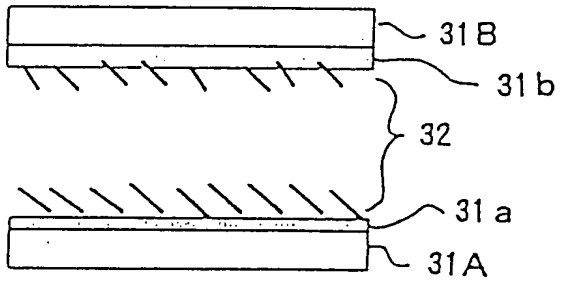
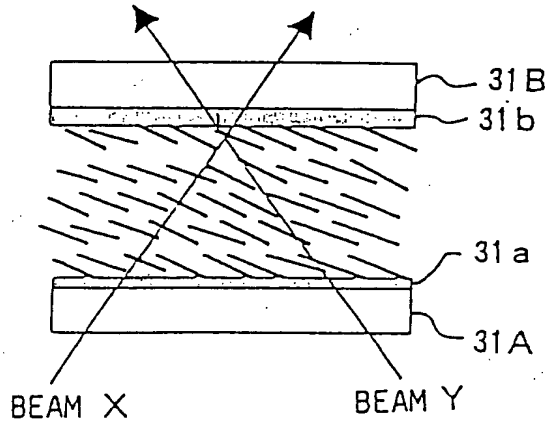


FIG. 82C



120

FIG. 83A

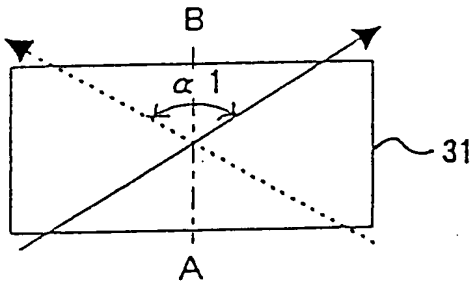


FIG. 83B

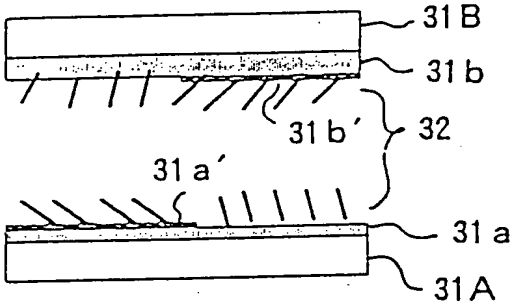


FIG. 83C

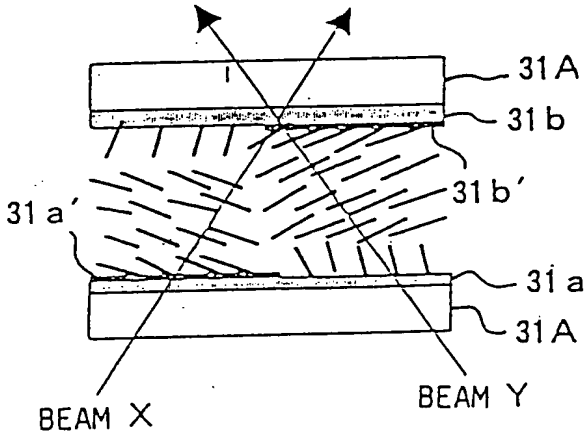


FIG. 84A

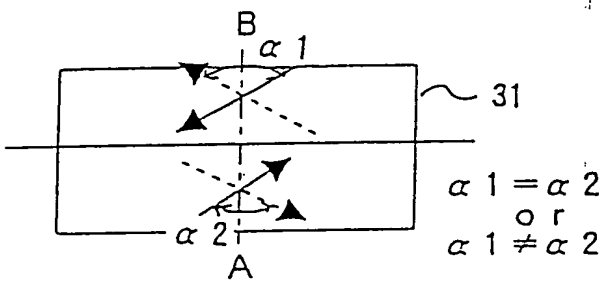


FIG. 84B

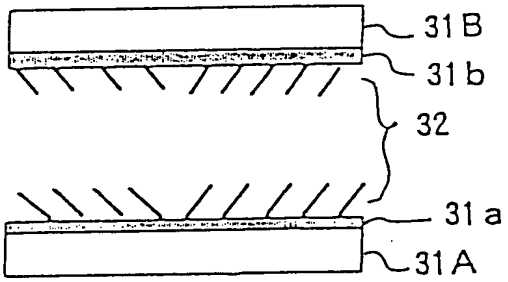


FIG. 84C

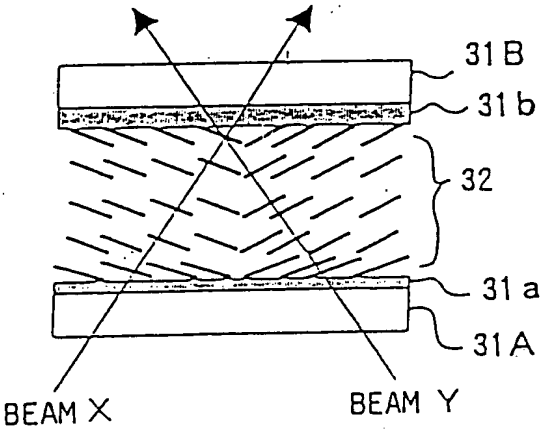


FIG. 85

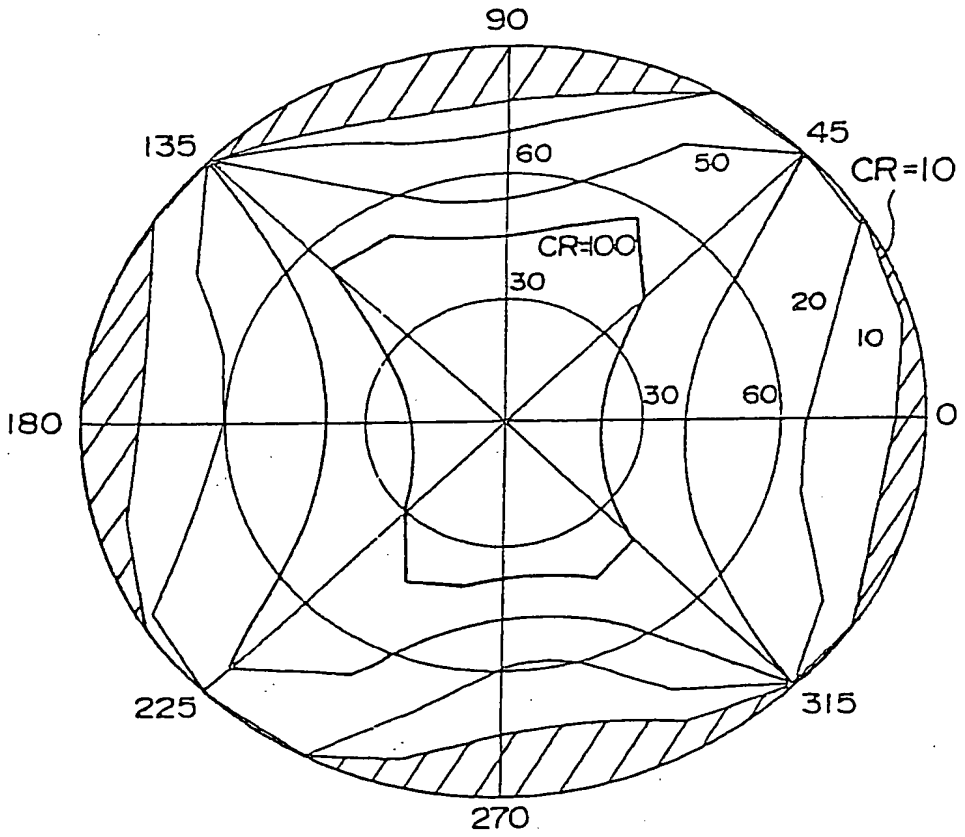


FIG. 86

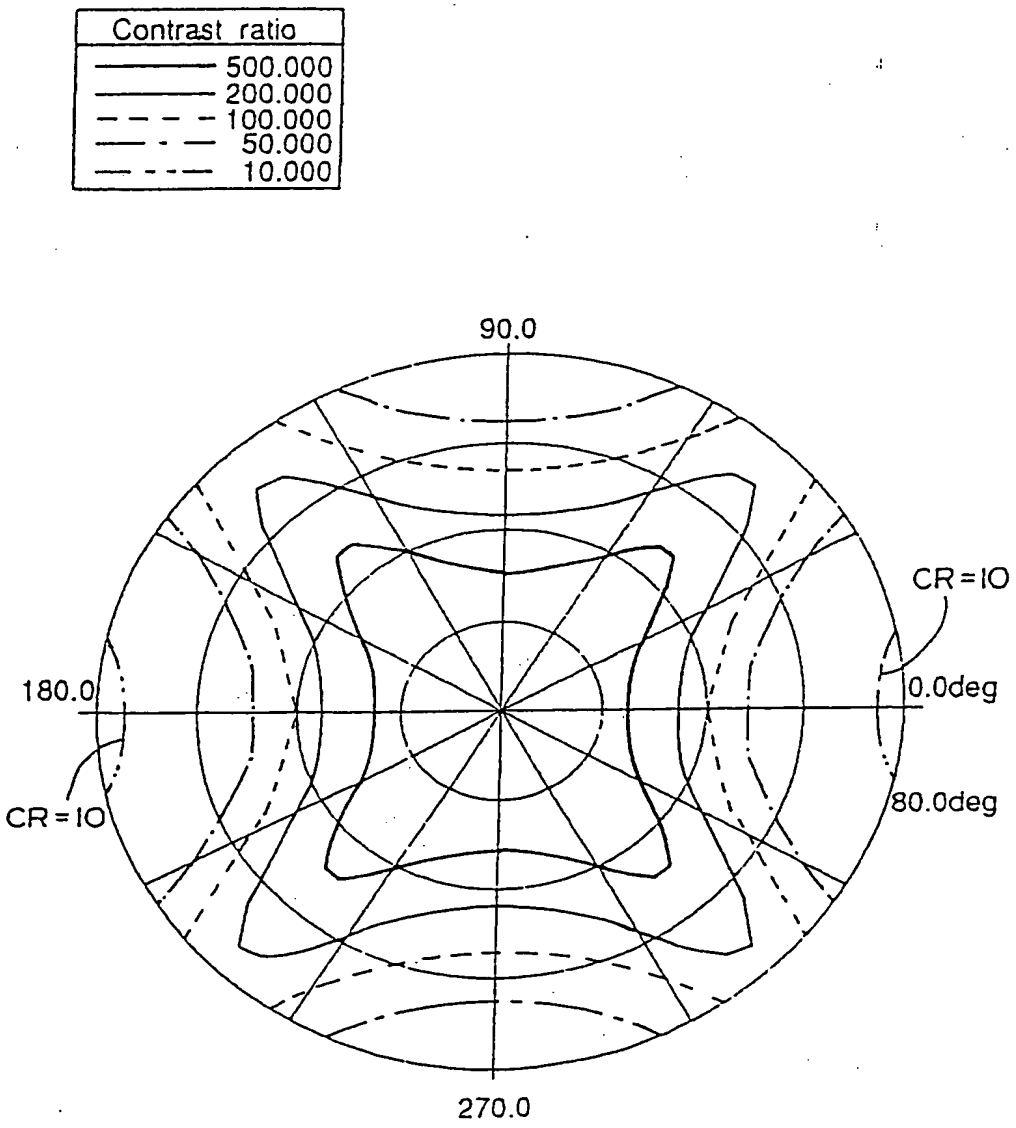

Contrast ratio
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
270.0
CR=10
CR=10
80.0deg

FIG. 87

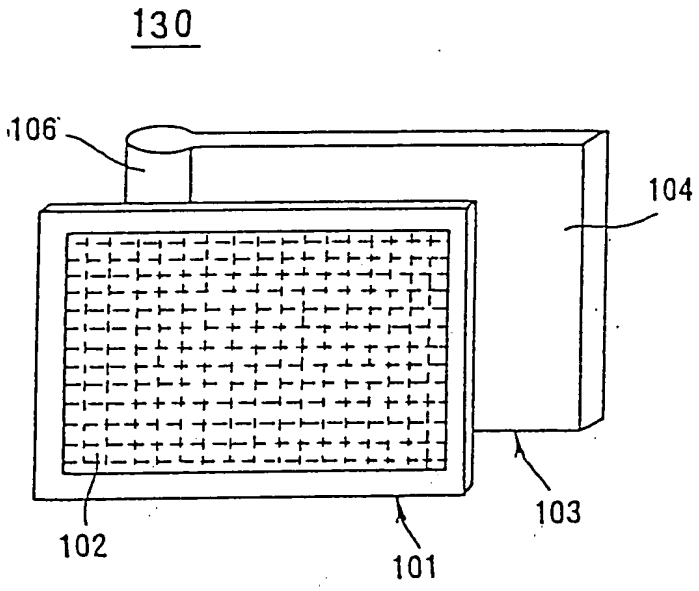


FIG.88

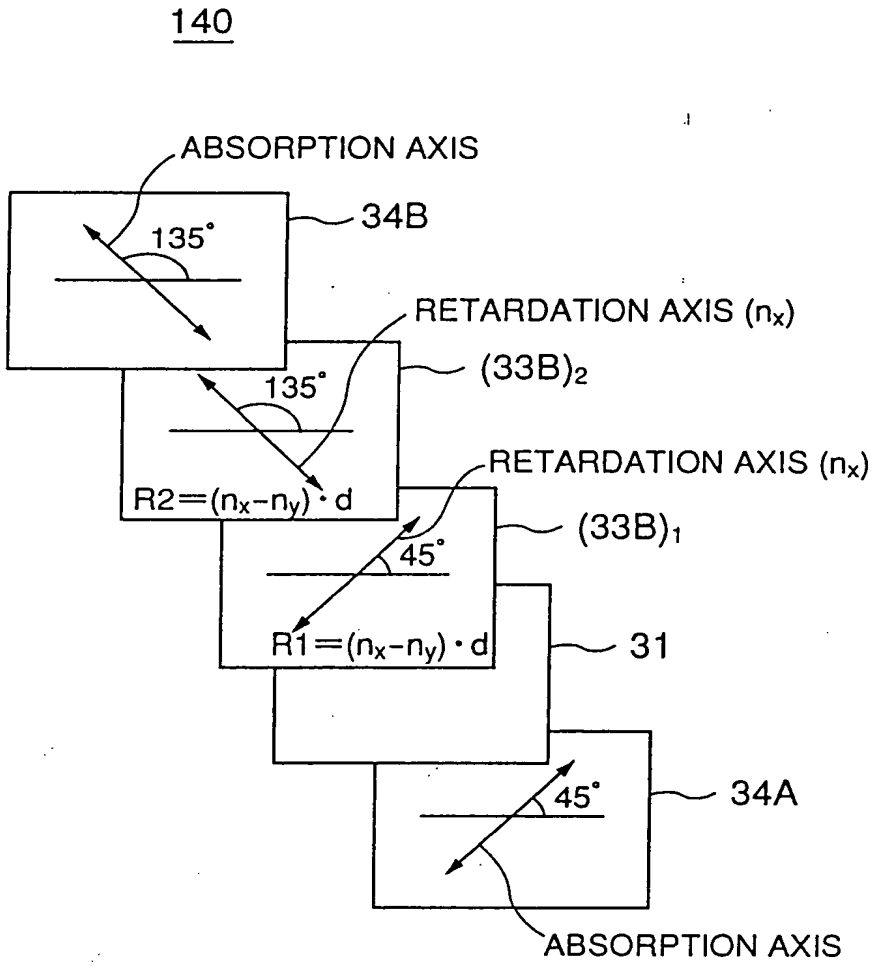

140
ABSORPTION AXIS
135°
34B
RETARDATION AXIS (n_x)
$(33B)_2$
135°
R2=(n_x-n_y)・d
RETARDATION AXIS (n_x)
$(33B)_1$
45°
R1=(n_x-n_y)・d
31
45°
34A
ABSORPTION AXIS

FIG.89

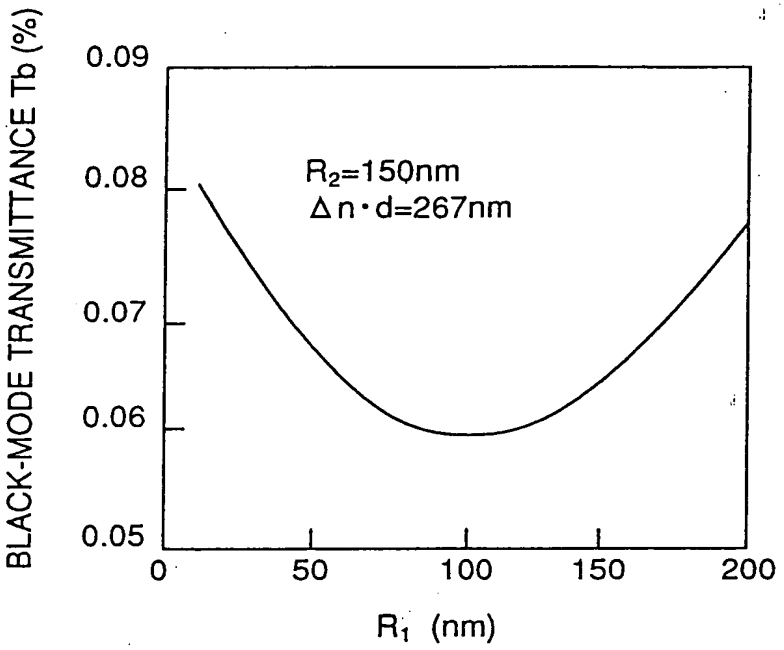

BLACK-MODE TRANSMITTANCE Tb (%)
0.09
0.08
0.07
0.06
0.05
0
50
100
150
200
R1 (nm)
R2=150nm
Δn·d=267nm

FIG.90

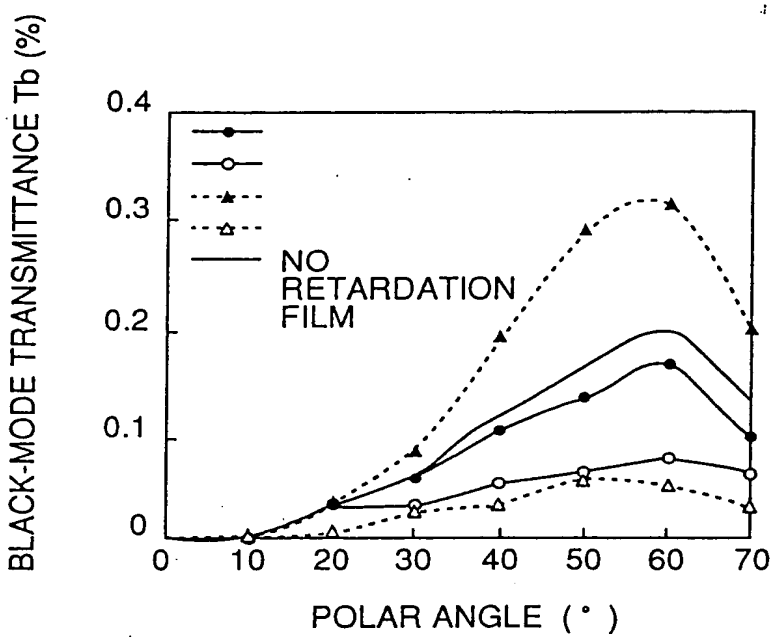

BLACK-MODE TRANSMITTANCE Tb (%)
0.4
0.3
0.2
0.1
0
NO
RETARDATION
FILM
0
10
20
30
40
50
60
70
POLAR ANGLE (°)

FIG.91A

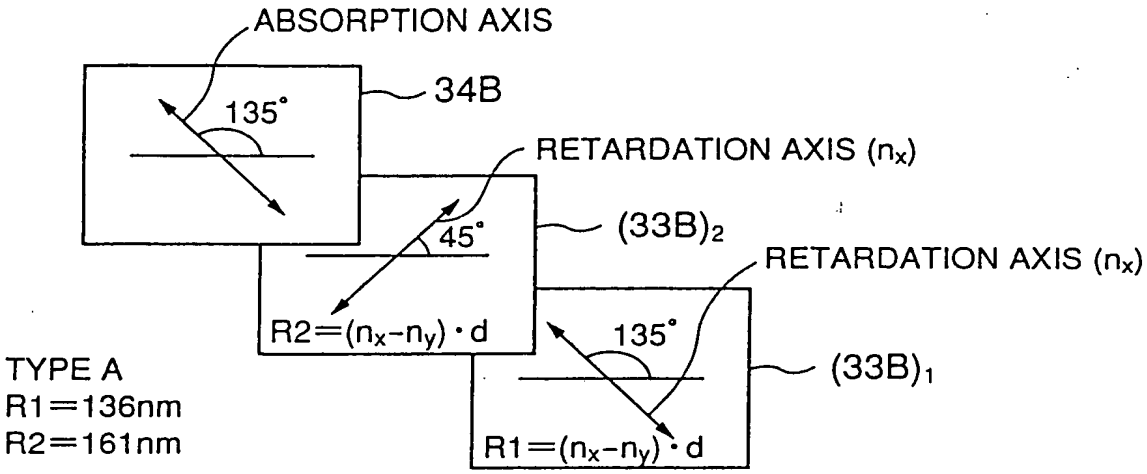


FIG.91B

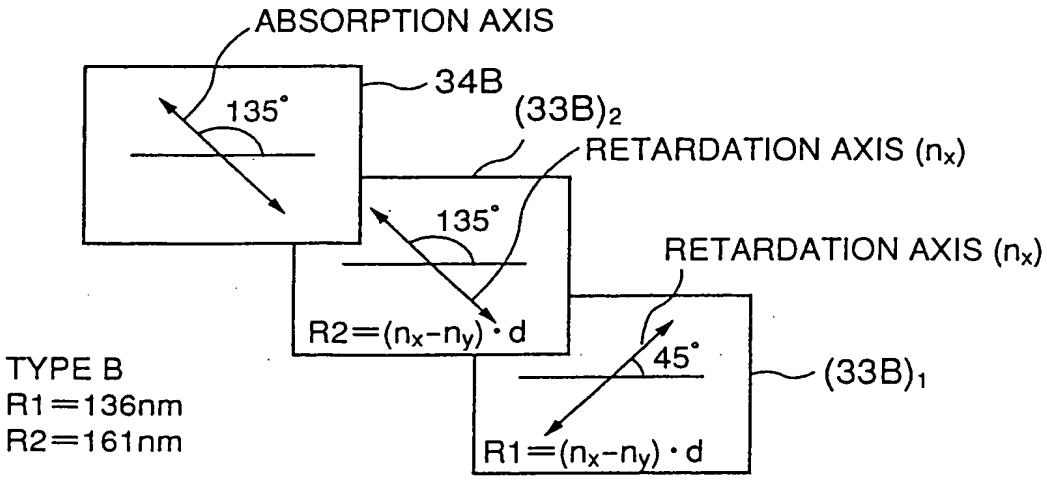


FIG.91C

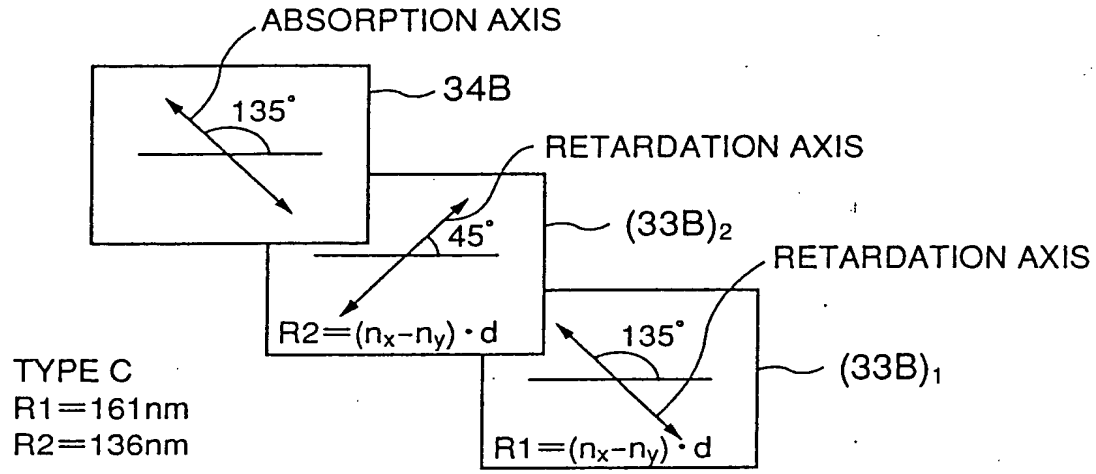


FIG.91D

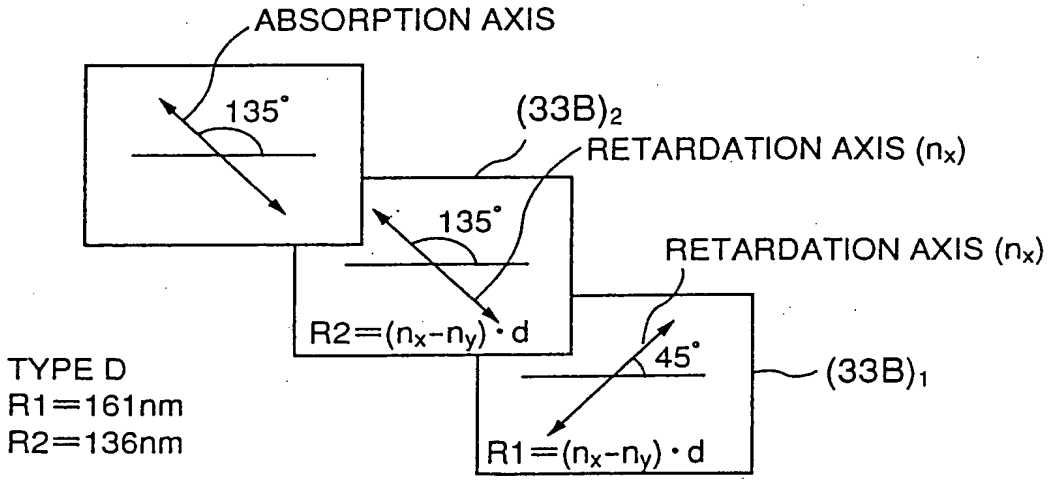


FIG.92A

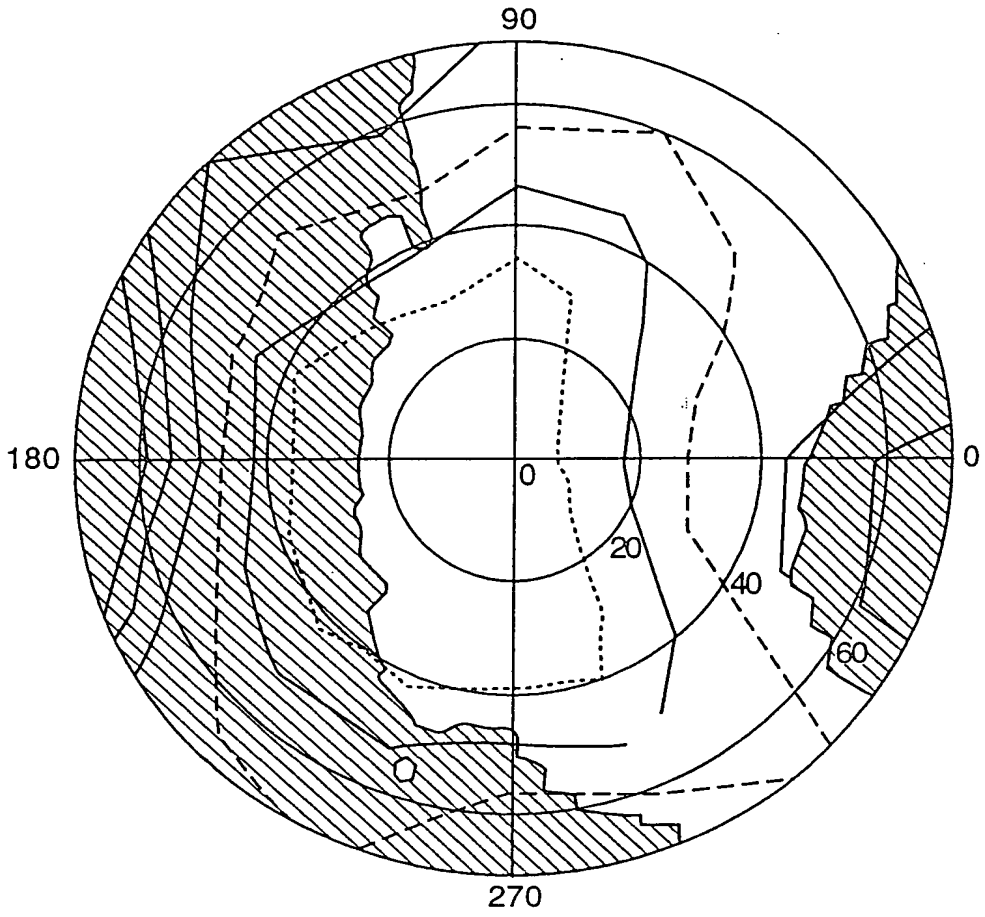


FIG.92B

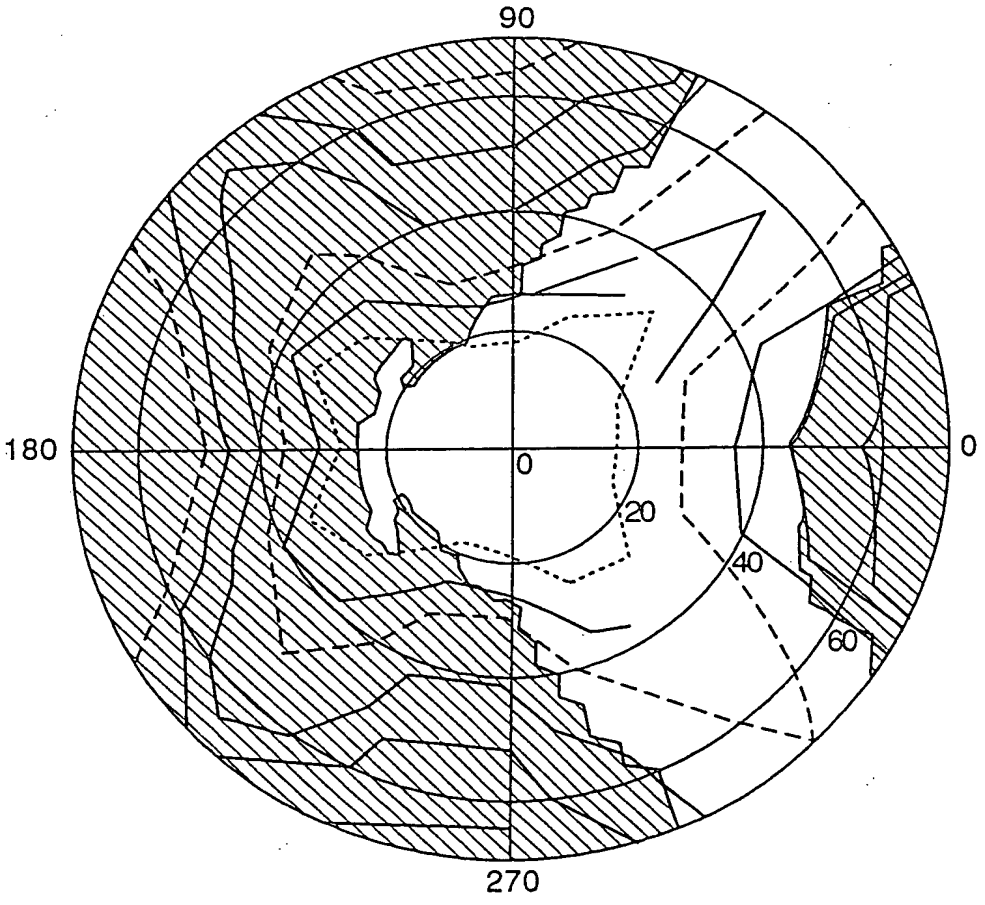


FIG.93

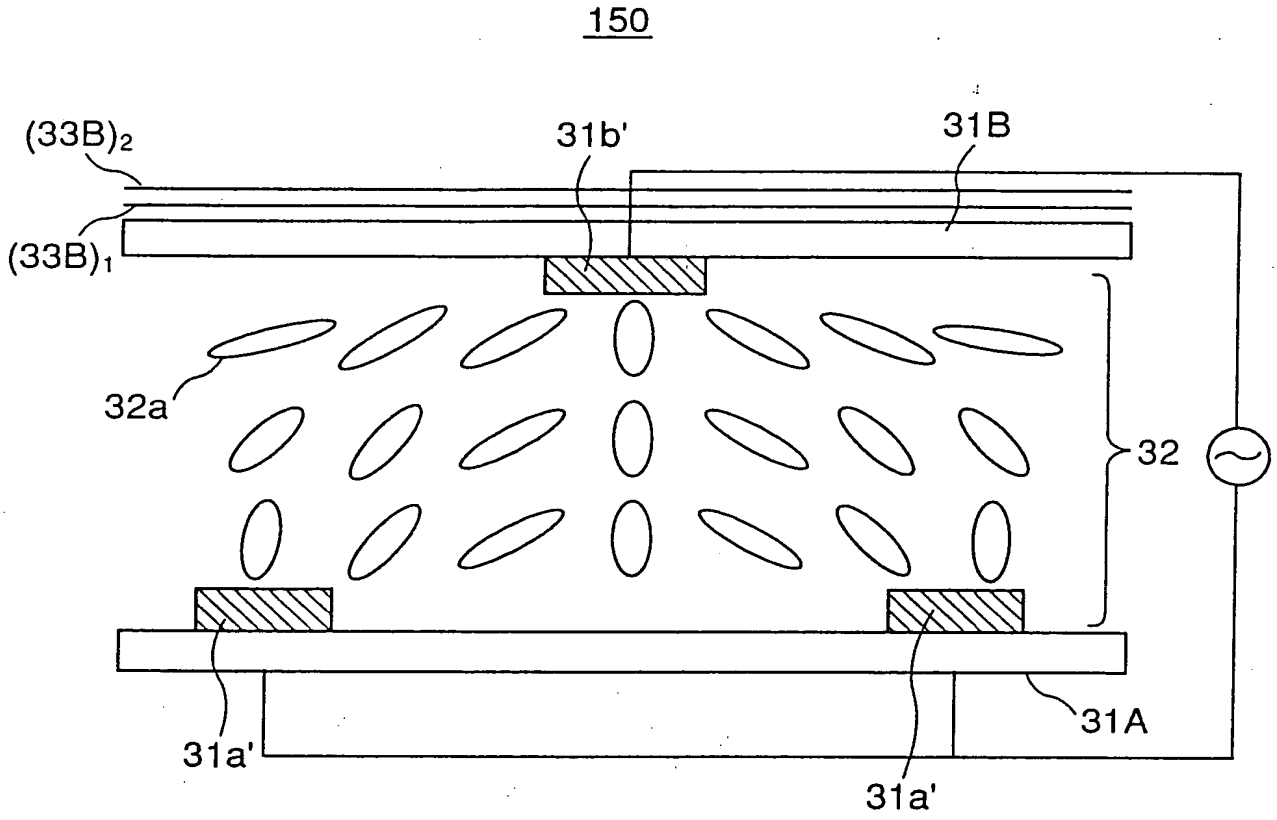
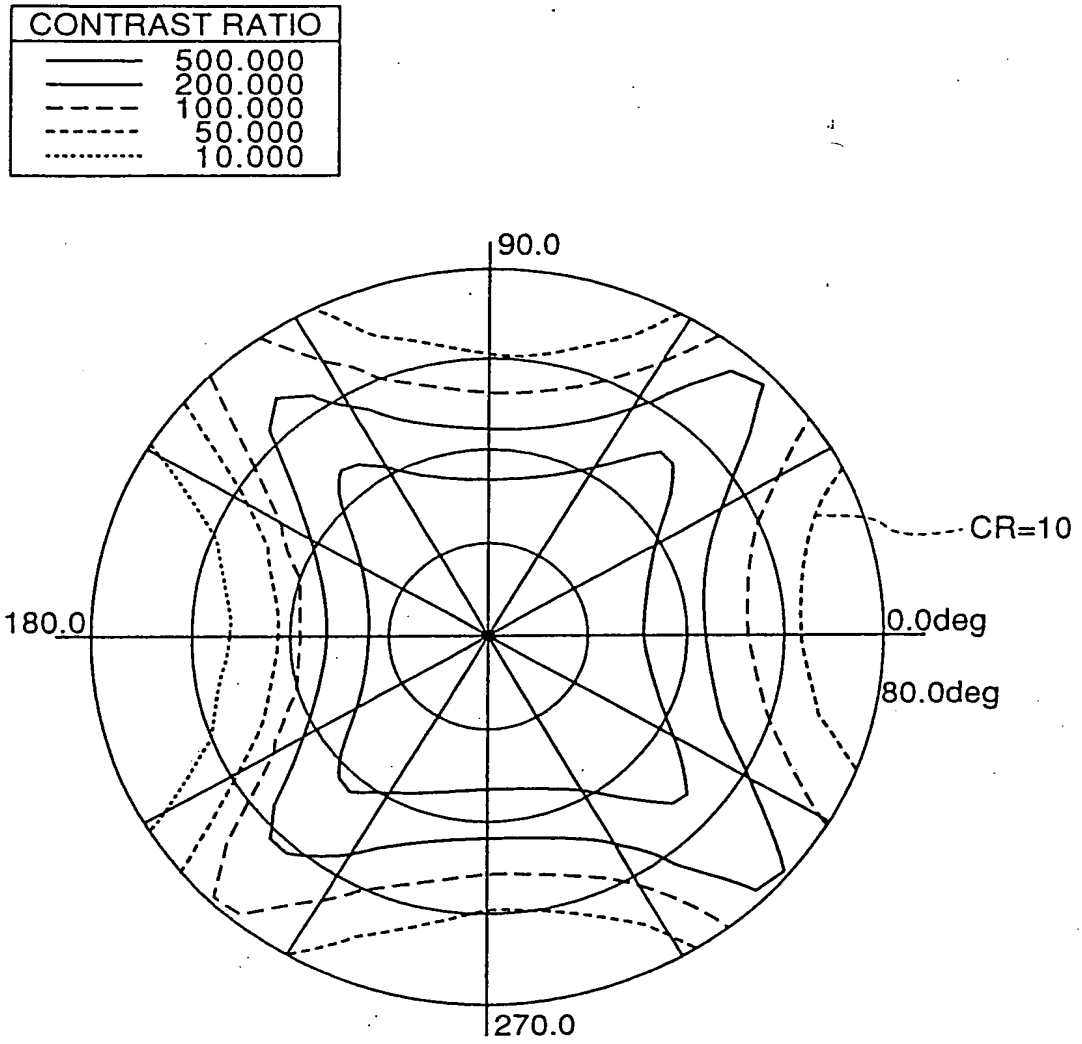


FIG.94


CONTRAST RATIO
500.000
200.000
100.000
50.000
10.000
90.0
180.0
0.0deg
270.0
80.0deg
CR=10